DOCUMENT RESUME

ED 061 064 SE 013 396

TITLE	The Third Wave. . . America's New Conservation, Conservation Yearbook No. 3.
INSTITUTION	Department of the Interior, Washington, D.C.
PUB DATE	66
NOTE	132p.
AVAILABLE FROM	Superintendent of Documents, Government Printing Office, Washington, D.C. 20402 ($2.00)
EDRS PRICE	MF-$0.65 HC Not Available from EDRS.
DESCRIPTORS	*Agency Role; *Annual Reports; Conservation Education; *Environment; *Federal Programs; Management; *Natural Resources; Photocomposition; Program Descriptions; Yearbooks

ABSTRACT

Concerned first with the definition of conservation and its problems, and then with specific actions by the Department of the Interior in response to these problems, this 1966 yearbook provides highlights of work done by the 26 bureaus, offices, and/or administrations within the Department. Coverage is broad, relating to many aspects of conservation in the United States in a descriptive, non-technical style. Numerous colored and black and white pictures, graphics, and accompanying narration serve to elaborate the theme of the endless task of restoring the balance of nature, man, and his institutions. Four special color essays are included depicting the ravages of man on the land, endangered wildlife, beauty of the National Parks, and the rising tide of education. (BL)

The Third Wave

. . . America's New Conservation

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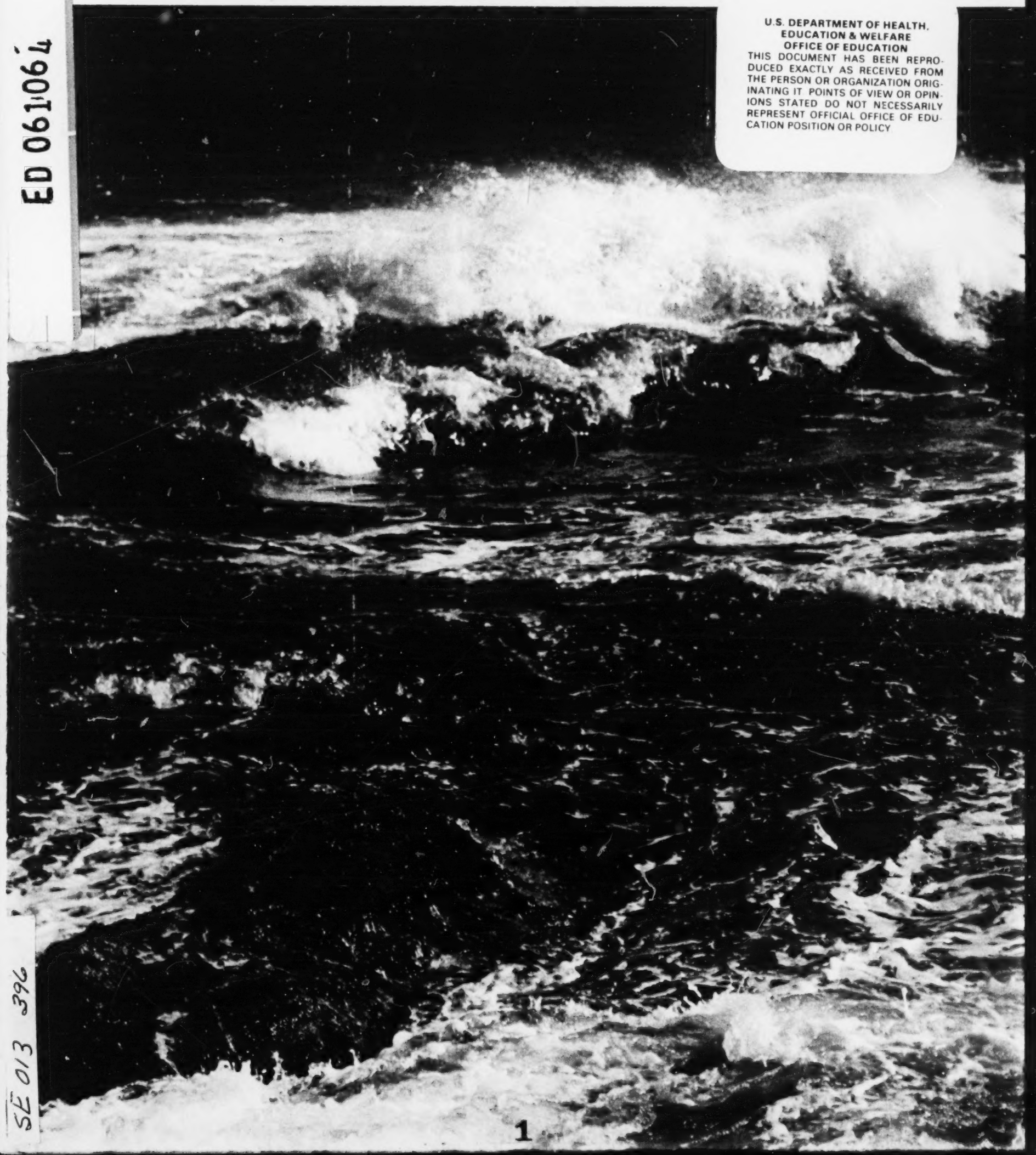

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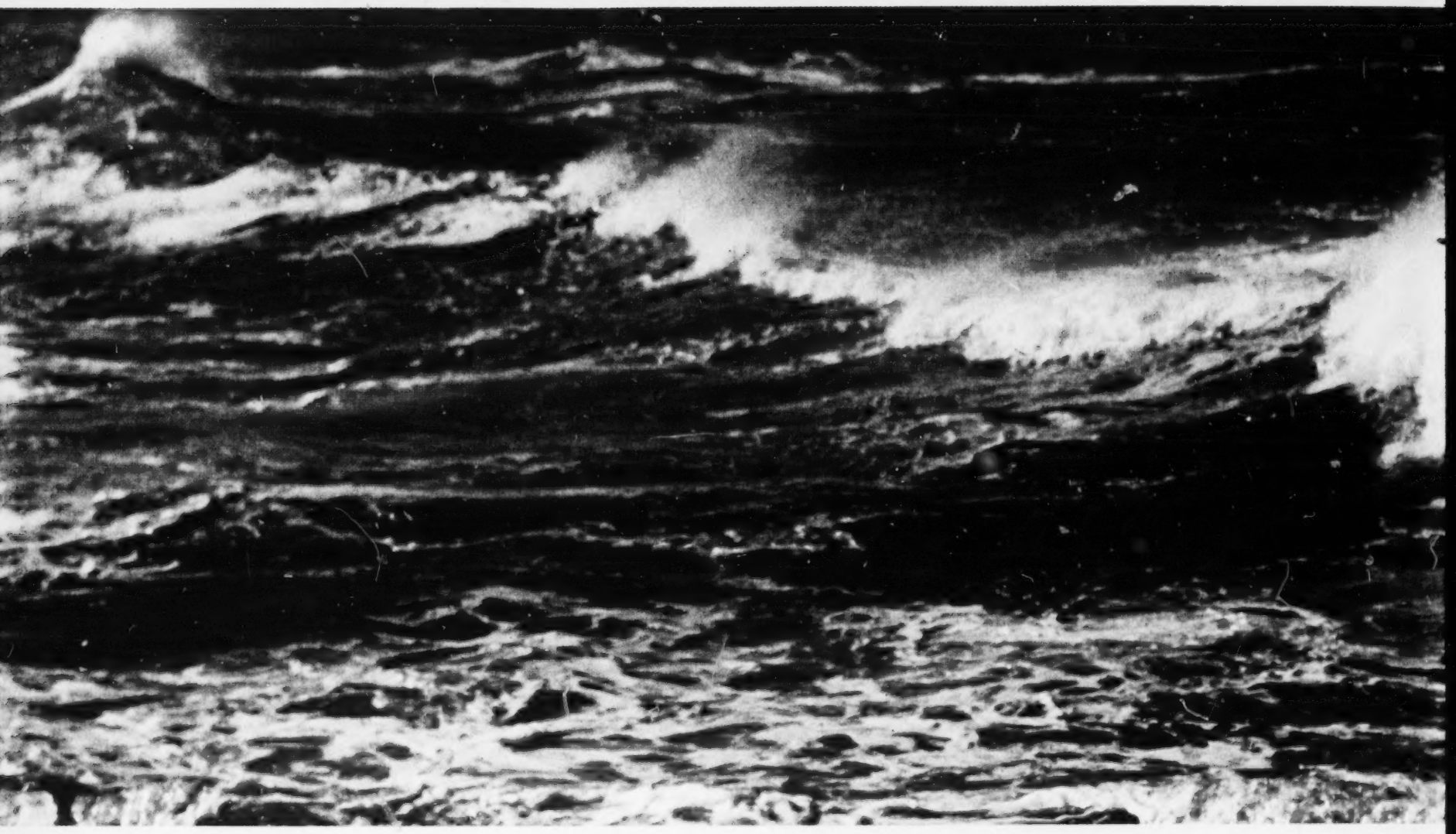


(Front cover and above) — Aquia — Chem., Inc. — Cleaver Brooks Co.

The Third Wave

CONSERVATION YEARBOOK NO. 3

Published by
the United States
Department of the Interior,
Office of The Secretary

A wave of seabirds.

David Larcher — © National Geographic Society

Our surroundings can enrich or impoverish our lives. Thus, conserving and improving our environment can add immeasurably to private and public happiness.

Vice-President Hubert H. Humphrey

Foreword

The Sixties will be memorably marked as years when man began to restore the balance between himself and his institutions, on the one hand, and his natural environment on the other. Now, at last, the right hand wants to know—and to clasp—the left.

The change in attitude began when we observed that we had not just conquered Nature—we had achieved overkill. We saw supine forests, exhausted rivers, sullen air, and realized that to the victor belonged only the spoiled.

We saw that environmental problems are interrelated . . . that these problems could no longer be fenced off. Water and land and air have ways of ignoring "no trespassing" signs and appearing, in every manifestation of their abuse, on both sides of any arbitrary dividing line. From the role of conqueror, man would move toward the role of partner.

The new, total thinking about conservation problems required an end to traditional approaches if we were to repel the rising tide and gathering momentum of environmental trouble.

Knowing this, the President and the Congress in 1966 took steps to centralize the national conservation effort.

The Water Pollution Control Administration was placed in the Department of the Interior and given a nationwide mandate to clean up this country's most abused natural resource—its streams, rivers, and lakes.

Interior was instructed to establish guidelines for water quality, and to see that these guidelines were adhered to by users of the Nation's water. Where formerly the Federal Government had *invited* and exhorted in the interests of water quality, it now was ready, where needed, to *compel.*

This responsibility to enforce water quality standards manifests no "outside" pressure, but rather represents the expressed wishes of the people of this Nation, acting through their Legislative and Executive branches. It is only one evidence of the citizen interest and ardor which are making themselves felt, straight across the conservation board—in every fiber and across every grain of environmental concern. The public *has* taken its stand in favor of building a quality environment.

With the addition of the water quality string to its conservation bow, the Department of the Interior became a truly national agency. For more than a century, since its founding in 1849, a transition had been going on. Originally conceived of as a "Home Department," it later was called "The Department of the West." But today, it most often is referred to as a "Department of Natural Resources," and its conservation mission is national.

Additionally, as almost every agency within the Department is affected by the new responsibility for water quality control, the overall conservation task will be subject to across-the-board programming.

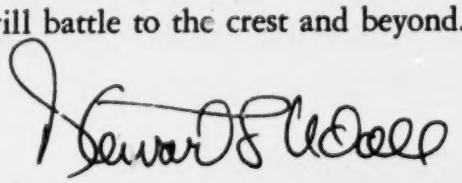
It also has been this Department's mission for the past several years to try to beat the bulldozer to the best of our remaining open spaces, and finally we have pulled ahead: There are plans to set aside for public pleasure 1.7 million acres in the 12 months beginning July 1, 1966, as compared to the one million acres we will lose to industrial, commercial, and housing developments. This represents a net gain of 700,000 acres in our outdoor savings account.

This race for inner space is only one of the many conservation responsibilities of the Department of the Interior, but, like our new assignment to clean up the Nation's waterways, it is an example of the kind of effort we intend to carry out in the humanizing Sixties.

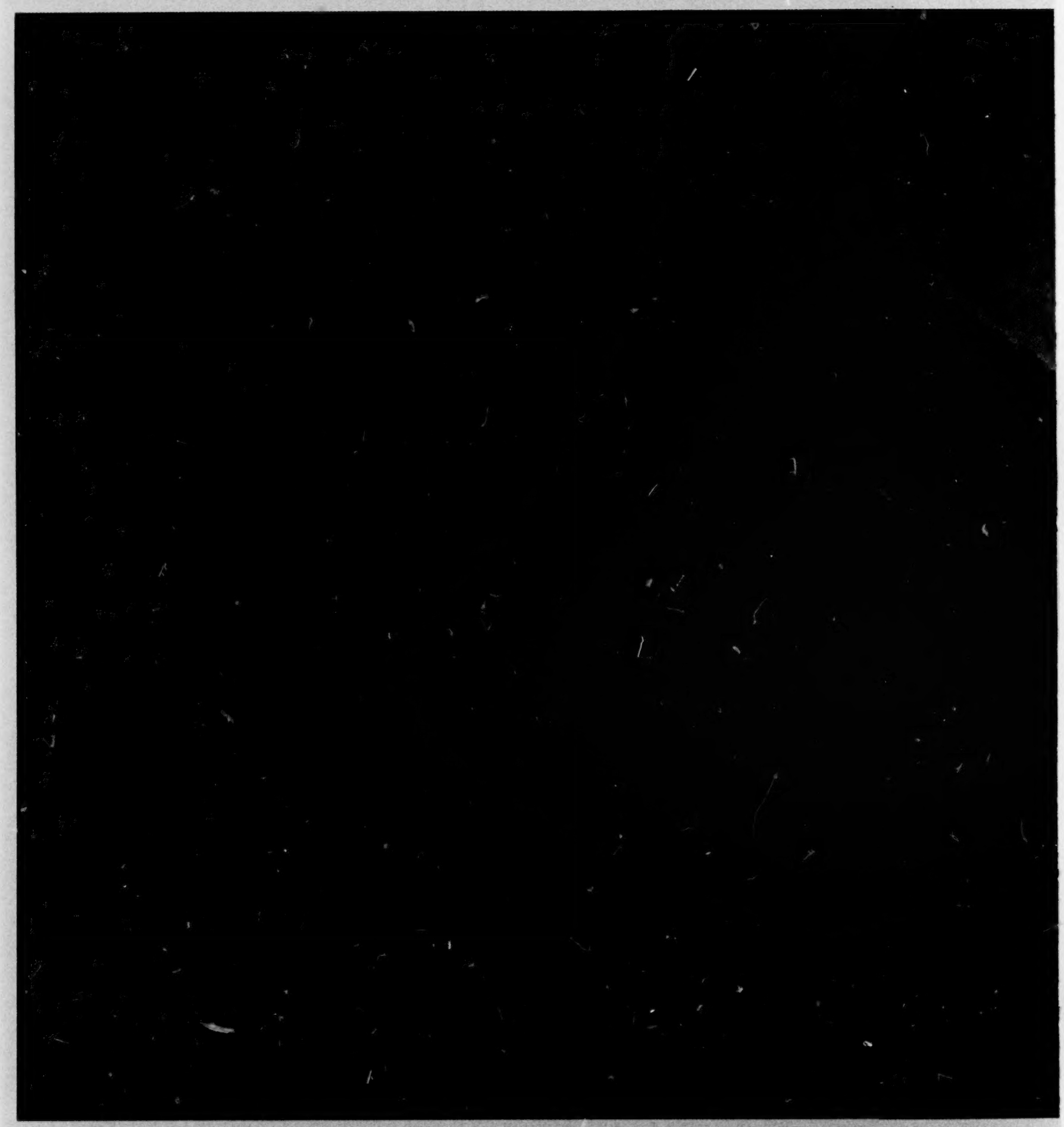
The pages of this booklet are concerned first with a definition of conservation and its problems, and then with specific actions by the Department in response to these problems.

With water as a primary concern, and with conservation poised on the threshold of its third historic phase, our title, "The Third Wave," is particularly appropriate. Upon this wave, truly, rides our future.

It is up to conscionable men to decide whether they will wallow about, or will battle to the crest and beyond.



Secretary of the Interior.



Morning mist on the lake in Virginia's Hungry Mother State Park.

Emory Kristof — © National Geographic Society

Contents

3 Foreword
7 Introduction
30 The Endless Task

31 Water Pollution Control Administration
40 Office of Water Resources Research
41 Geological Survey
47 Bureau of Reclamation
55 Office of Saline Water
56 Bonneville Power Administration
59 Southeastern Power Administration
59 Southwestern Power Administration
59 Bureau of Commercial Fisheries
66 Bureau of Sport Fisheries and Wildlife
70 Bureau of Outdoor Recreation
84 Bureau of Mines
88 Office of the Science Adviser
88 Bureau of Land Management
94 National Park Service
114 Bureau of Indian Affairs
121 The Virgin Islands
121 Trust Territory of the Pacific Islands
122 Guam
123 American Samoa
123 Office of Coal Research
123 Office of Oil and Gas
123 Oil Import Administration
124 The Alaska Railroad
124 Board on Geographic Names
124 Office of the Solicitor

SPECIAL COLOR ESSAYS

9 Man was here . . .
71 Going . . . going . . . almost gone!
95 A Parade of National Parks
125 The Rising Tide

Quality of the environment, like freedom, must be protected and achieved anew by each generation.

Laurance S. Rockefeller, President,
American Conservation Association

Introduction

The third wave of conservation has been gathering form and force since the beginning of the Sixties. It began as a logical extension of the conservation movement—historically, rooted in the mid-19th Century and given fresh impetus and new goals in the early 20th Century.

If the movement's various crests can be characterized in three words, the first would have to be "preservationist," the second, "regulatory," and the third — still gathering momentum — "ecological."

Conservation with an ecological emphasis is a way of happily relating man to his natural resources. The white man's occupancy of this continent, with its particular set of resources, began 350 years ago, and his way of relating to these resources was dictated at first by the wild condition of the land. There was nothing whatsoever of a land ethic: He simply ripped and tore and gouged and slashed what he needed from a seemingly endless supply. In the process, he killed, ruthlessly. He lost many people in that early struggle with Nature, so every time Nature lost a battle he quite naturally regarded it as a victory for himself.

It was then that he talked about progress in terms of expansion—so many people, so many towns, so many ships, and later, so many railroads and so many automobiles.

The idea of conservation was born in the mid-19th Century when men finally began to think of their natural resources in terms of wise use. Since then, we have gone through two distinct phases of defining our relationship to our resources; in one important sense, we have come full circle in this new emerging phase. The anchor link in this circle is the thoughts of George Perkins Marsh, who in 1864 wrote "Man and Nature." In that book, he sounded the alarm which led to the first wave—the preservationist wave—of conservation. But even in 1864, Marsh was actually pleading the ecological cause. He wrote then that to disturb the balance of nature without calculating the consequences was to invite disaster. He pointed out that the web of life was made up of every single living organism and warned that destruction of any part of that web might disrupt the whole biological community.

"Man is everywhere a disturbing agent," he wrote. "Wherever he plants his foot the harmonies of nature are turned to discord."

Marsh, a Vermont attorney turned conservationist, was literally a voice in the wilderness. Contemporary society, bent on survival within relative wilderness, was not yet ready for this kind of gospel. But the message he preached did touch off the first wave of conservation, and the second-wave 20th Century conservationists wrote their own version of the land-man ethic—a regulatory version which for the first time threw the restraining power of the Federal government into support of the public interest. Theodore Roosevelt led the reaction against ultra-individualism and during his time as President the positive Federal program for conservation began to take shape.

After the postwar lull of the 1940's—during which we gathered our strength, overtook our wartime production lag in consumer goods, and continued to admire our soaring Gross National Product—our country again looked to its conservation task. This time, the ecological approach put forth by Marsh in 1864, and the earlier positive Federal program advocated by John Quincy Adams to a deaf country in 1832, began to make sense—in a very literal, personal, even intimate way—to the majority of Americans.

The first stirring of the third wave, early in the Sixties, was marked by the ecological message of interdependency starkly written by such dramatic conservation failures as the Mississippi fish kill and the death-dealing Donora, Pennsylvania, smog tragedy. It became apparent that the web of life is as total as the web of environment. The interdependence of these two comprises "ecology."

As the web of environment is brought into view, we are forced to abandon narrow preoccupation with such isolated conservation categories as forests, wildlife, minerals and water. We recognize their interdependency and the need to consider them as a whole. We find that if we can't chop our conservation task into categories, neither can we "city limit" it. Conservation was once primarily a country matter. Today, the concern for a quality environment has expanded to include our great urban complexes. With 75 percent of the people living in cities and more on the way, the term "environment" has to include city life and its surroundings. Billboards, smokestacks, polluted water, noise and smog—these have now joined the list of conservation villains. And the social sciences have now entered upon the scene—to question some aspects of our former outlook. In the early decades of the 1900's, we had supreme faith in our technology, we were politically isolationist, vocationally specialized, and highly individualistic in social habits. The public philosophy that grew out of this amalgam was one which allowed men to act in relation to their environment and to each other without concern or responsibility for the consequences which their actions produced. It was the age of the irresponsible specialist and it resulted in the Period of Pollution which we are just now beginning to try to control.

The social scientists are emphasizing today that we live in a dual world of *two* external environments. One is the world of nature, the cradle of our species and still the nourisher of our existence. The other is the world man has built within and around the world of nature. Roland C. Clement, staff biologist for the National Audubon Society, describes this man-built world as "including all our technologies, from the axe and the hair shirt to electric power and atomic fission; and all our media, from the alphabet to telstar and television."

The task of conservation today is to apply human understanding and wisdom to the dual environment in which we

live. Conservation, which began with wildlife protection and grew to habitat preservation, must now extend its concern to the man-made environment. It must recognize that in an ecologic age, our technologies — whether TV, typewriters or electronic computers—are just as much national resources as fossil fuels, forest products or wildlife. They are cultural resources rather than natural resources, but they form an increasingly important part of men's lives and they require increasingly sophisticated watchdogging if they are to be made to serve and enhance the quality of human life.

The triumphs of science have not been harbingers of unalloyed blessings. Indestructable plastic and aluminum containers upgrade the preservation of foodstuffs and beverages but they can also downgrade the aesthetic qualities of the nation's roadsides and waterways. The end of our world could be neither a bang nor a whimper. We could simply smother in the wastes of our own affluence. The fault lies not with the progress of technology. It is rather with the lag of conservation measures.

New and impressive technological tools are powerful extensions of man's hands and feet and eyes—his ability to move and control and change. With these tools we can either accelerate the headlong course of sprawl and pollution and blight, or we can give direction toward wise development and use. Which factors can be allowed to run along unchecked? Which can we bend and for what? In point of fact, is there such a thing *left* as what we used to call "a natural course."

In a world where the sheer weight of population has created strains on nature never before known on this planet, is all our scientific muscle and economic power enough to keep the planet from sickening and dying?

Conservation, if it is to have any real meaning for man, must relate primarily to man. But must it serve only his most immediate, short range needs? We have projections running out of our computerized ears . . . population expectations with the attendant demands on fuel, water, minerals, urban expansion room and job opportunities. Added to these and myriads of other solid projections we have the scientific and technological imponderables which continue to pour from our laboratories—discoveries which could knock any or all of our projections into the proverbial cocked hat.

But it is not only the extension of our power to alter nature which threatens to upset our vital balance. It is also the speed with which we apply these new and often untried tools. Our cultural attainment is the result of our ability to pass on, from one generation to the next, the accumulated knowledge of past centuries. But the dizzy pace of scientific progress now bids fair to cancel out experience as a factor when humans deal with their environment. As chemicals, synthetics, sprays and gadgets proliferate, in the interests of pest control or cleanliness or merely to satisfy the passing whims of growing numbers of human beings, we are altering our environment so drastically and at such a rapid rate that the experience of the father is often too late to be of help to the son. "Nature never makes haste," Thoreau observed. "Her systems evolve at an even pace." Man's progress, on the other hand, has accelerated to such incredible velocity as to suggest that the course must be downhill.

Does a downhill course, no matter how well we negotiate it, represent progress? We have only to look about us to decide. Where short term economic wealth alone is allowed to set the course, the amenities of nature are heedlessly shouldered aside.

Rene Dubos of the Rockefeller Institute calls man basically a creature of Nature who has only lately become a creator of Nature. "Throughout the centuries," Dubos says, "man worshipped Nature. He still does, but now he does it with a sense of guilt."

This guilt might well turn to remorse or despair if the current findings of some sociologists and scientists are an indication. They inform us that much of what formerly passed as merely aesthetic or sentimental concern for environmental quality is now turning out to be a matter of sheer biological-psychological necessity. Violent biological or psychological reaction in humans can hardly be discounted if environmental conditions are allowed to become increasingly hostile.

One of conservation's most urgent tasks today is to create a general awareness of ecology in both its biological and sociological senses. Public expectation must be elevated to require a more responsible performance from everyone—whether that "one" be citizen, corporation, or some agency of government.

The new conservation requires also a political machinery for formulating public policy—a task which often involves a difficult choice between conflicting public interests and private demands. When concerned people—leaders of the community or merely citizens interested in a certain project—get together and work out ways of accommodating the interests of the various "publics" involved so that the greatest good is wrought with the total environment in mind, then the politics of conservation are working at their best.

And when leaders of nations, such as President Johnson of the United States and Chancellor Erhard of the Federal Republic of Germany, exchange teams of scientists and government officials in a mission designed to enhance the environment, the politics of conservation take on a new dignity and a new dimension.

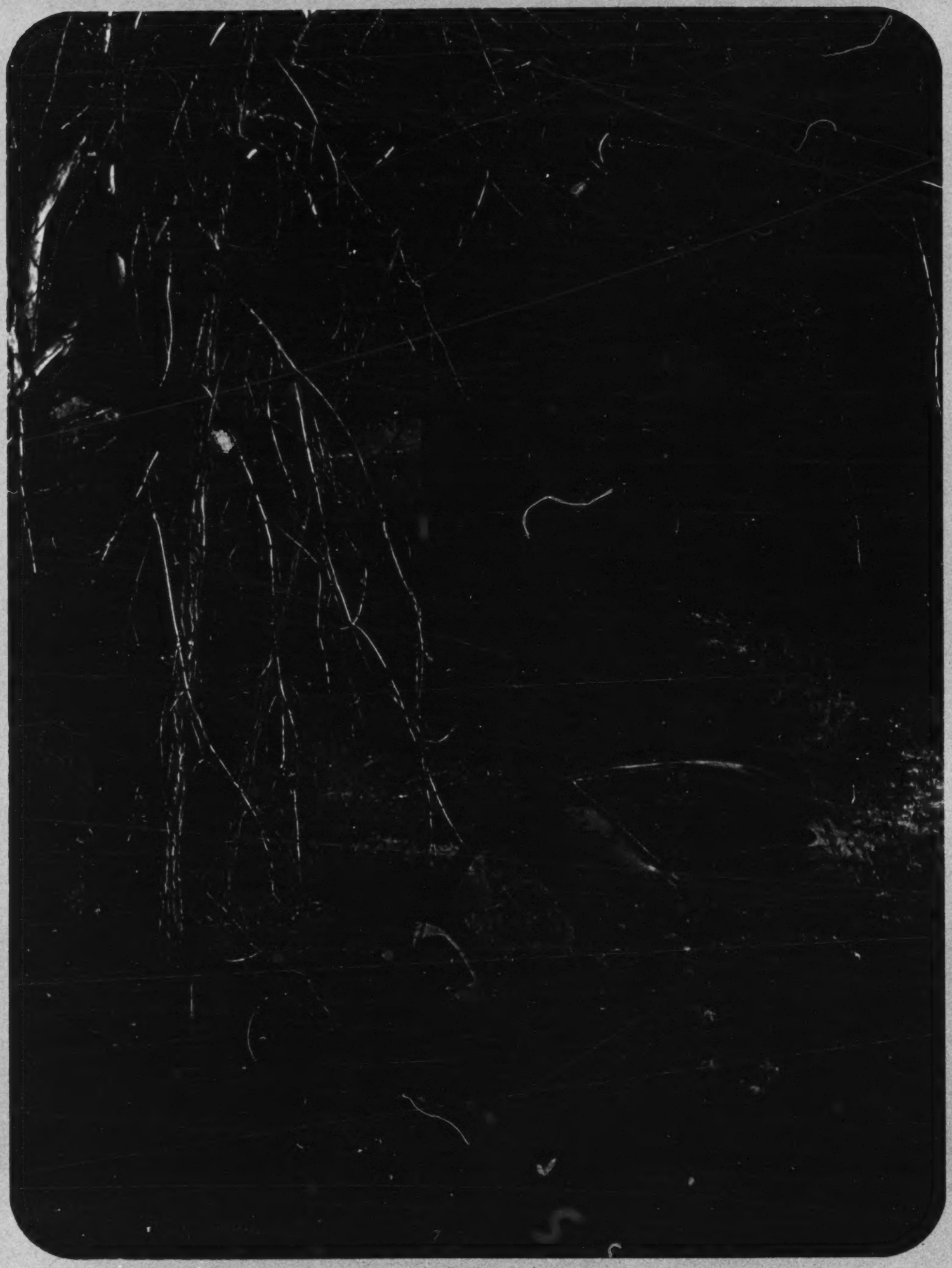
The new conservation is reluctantly exploding the Growth Myth, and this marks the beginning of a whole new set of societal values. The new value system sets greatness above growth, puts quality ahead of quantity—and demands that all the corporate parts of America do the same. It takes a hard new look at technology and applies prudent brakes to the bulldozer in order to give proper consideration to balance. It weighs what one action would accomplish against the values conserved by not taking it. It assigns full value to wisdom in the balance against dollars. It recognizes the folly of reckless expansionism and the urgent need for guidelines to wholesome growth. It turns its back on "making do," and applies itself to "making well."

The task facing the Department of the Interior and all of America's millions is not a small one, but neither is the size of the disaster which awaits us if we default. As we delay planning and action, development runs ahead at breakneck speed. In the words of President Johnson:

"Let us from this moment begin our work in earnest—so that future generations of Americans will look back and say: 1966 was the year of the new conservation, when farsighted men took farsighted steps to preserve the beauty that is the heritage of our Republic."

Man was here . . .

MAGNUM — Ernst Haas — "World Science Annual-1965" — Field Enterprises Educational Corp.



An American scenic

A Picture Essay

. . . digging . . .

Here come the highways.

12 58

Fritz Chemical — PPG Coatings and Resins Magazine

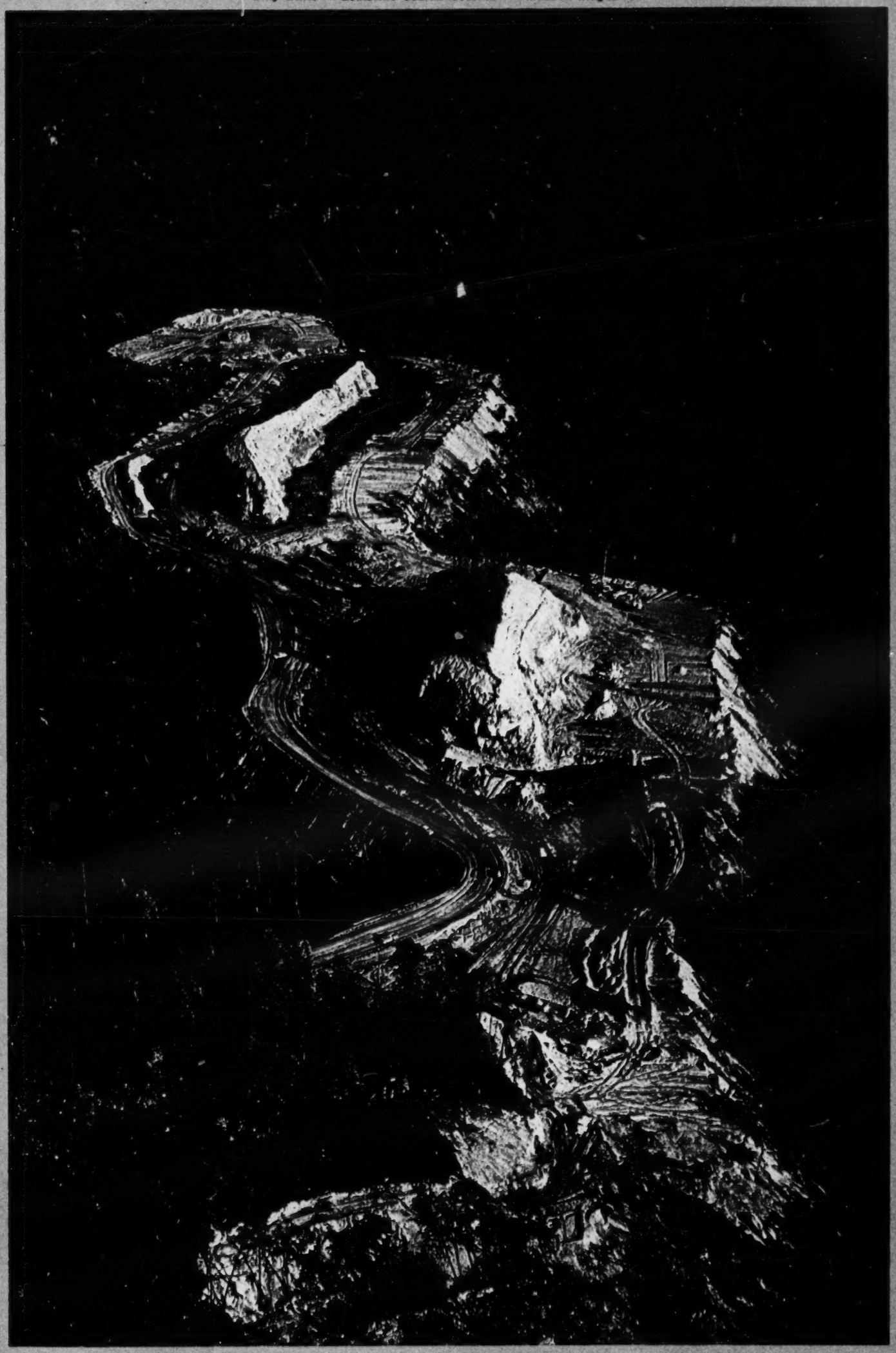
. . . cutting . . .

There go the redwoods.

Joern Gerdtz — Time Magazine

. . . gouging . . .

Billy Davis — Louisville Courier Journal — Audubon Magazine



Another Southern Appalachian mountain peak is leveled in the scramble after coal—the black gold.

. . . polluting . . .

MILLER SERVICES LTD. — Karl Sommerer — "World Science Annual-1965" — Field Enterprises Educational Corp.

(Above) Fumes from a nickel plant have denuded a once-lush forest land near this industrial town.

(Below) Wastes from a Buffalo steel plant help poison the once-sparkling waters of a dying Lake Erie.

Public Health Service — The National Observer — Dow Jones & Co., Inc.

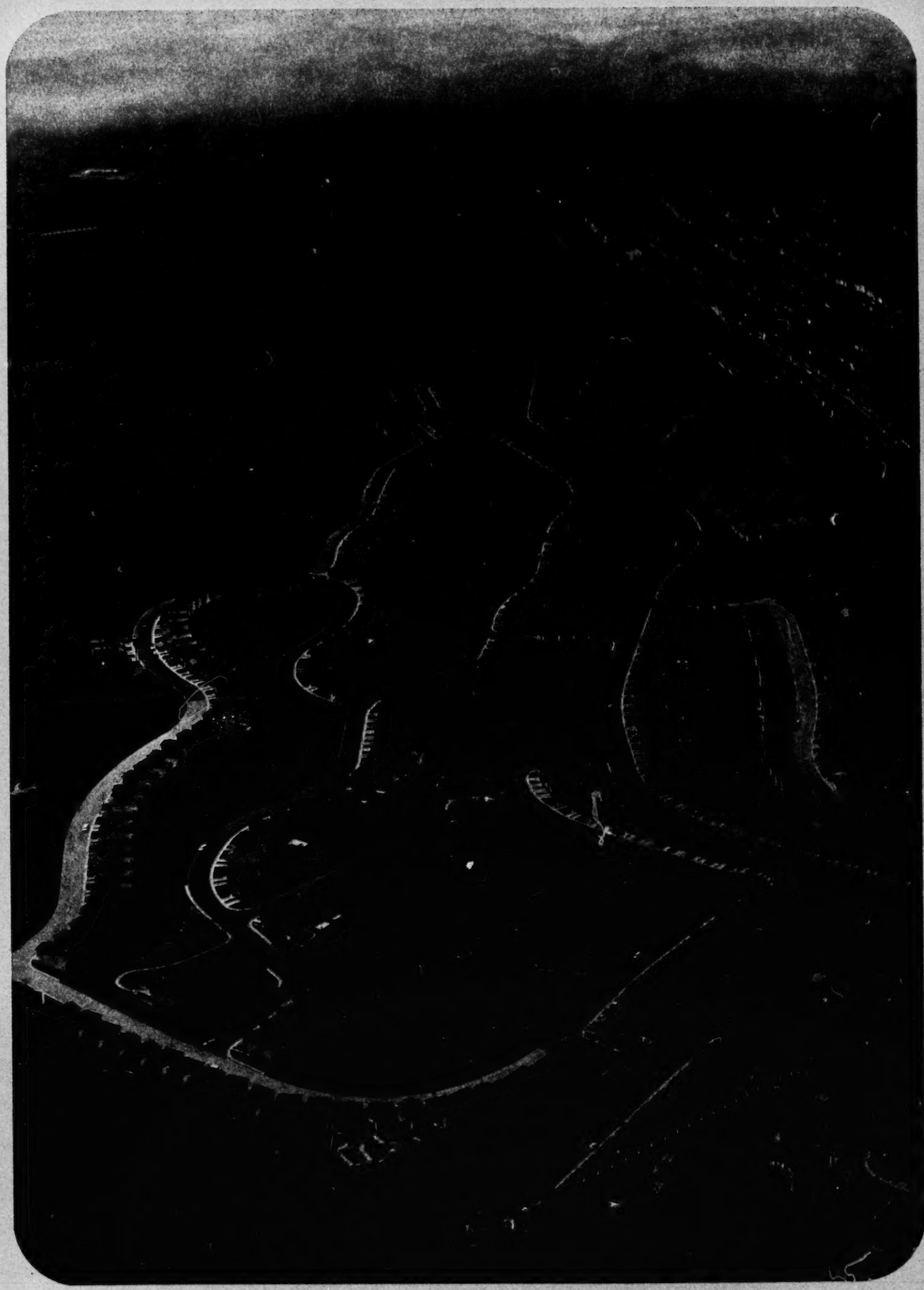
. . . dumping . . .

Leviton-Atlanta — Time Magazine

Derelict automobiles clutter an abandoned drive-in movie and spill over into the surrounding countryside.

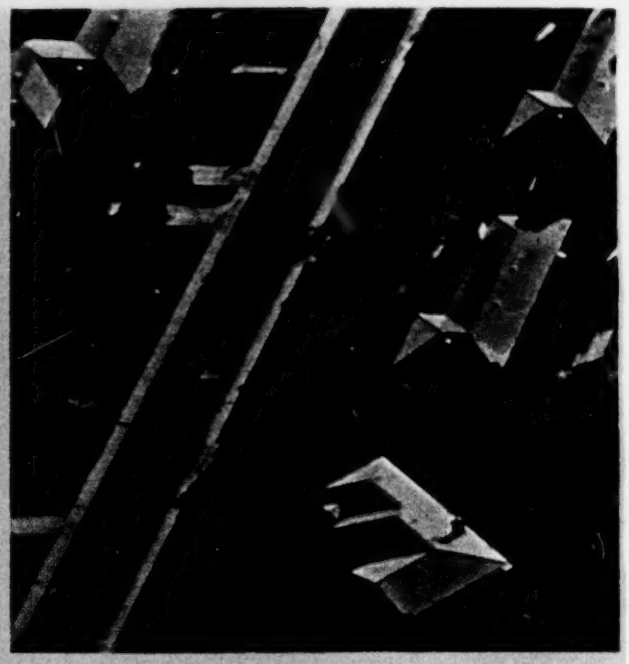
. . . reshaping . . .

© National Geographic Society

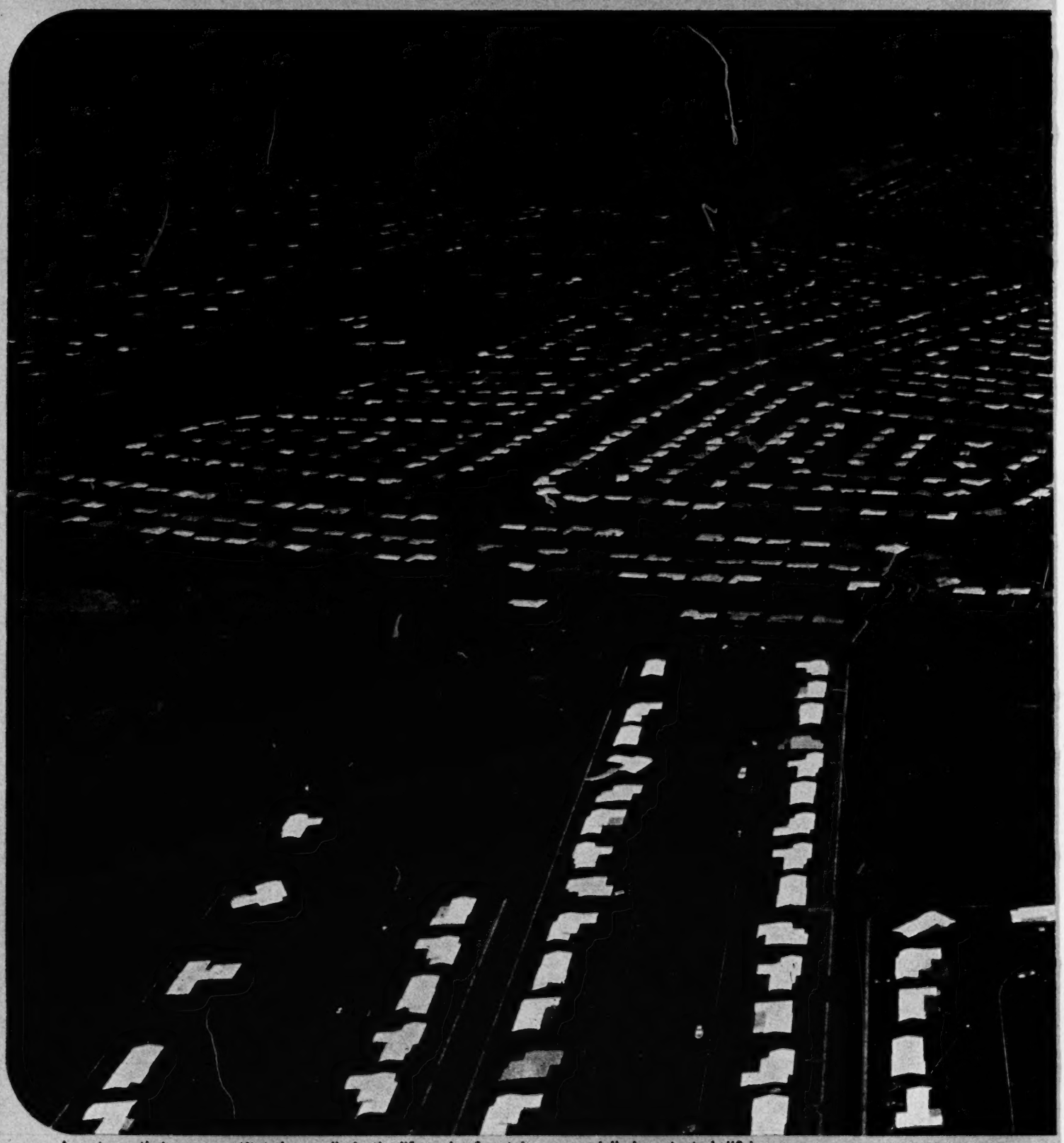


Close-packed, look-alike houses lace a mountainside south of San Francisco, reshaping Golden Gate landscape.

...regimenting...



James P. Blair — © National Geographic Society



An estuary that once constituted a cradle in the life cycle of certain commercially important shellfish, now provides the foundations for another suburban development. Such violence breaks the coastal chain of marine life.

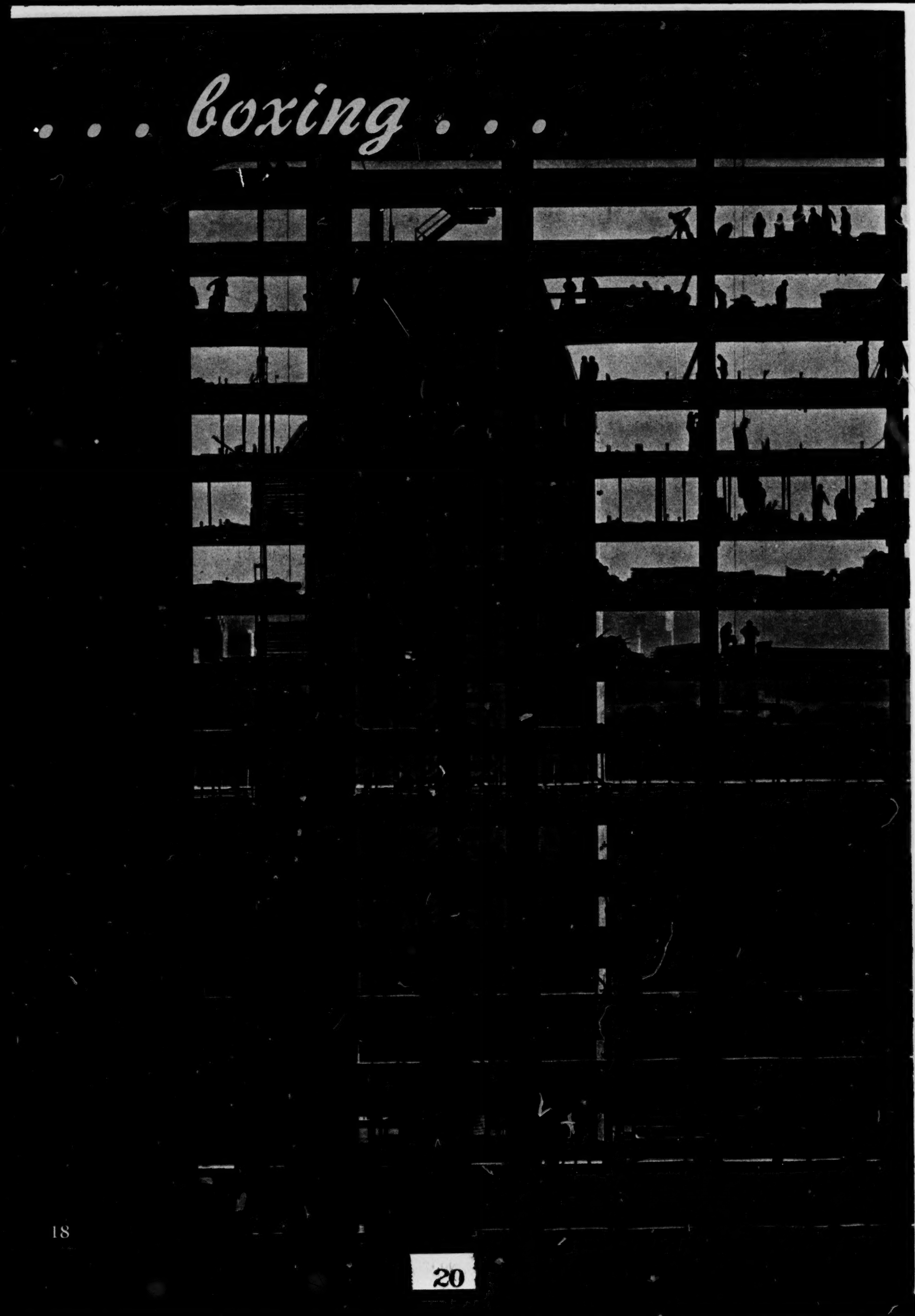
Luxurious homes, complete with private swimming pools, turn a former orange orchard into a residential neighborhood.

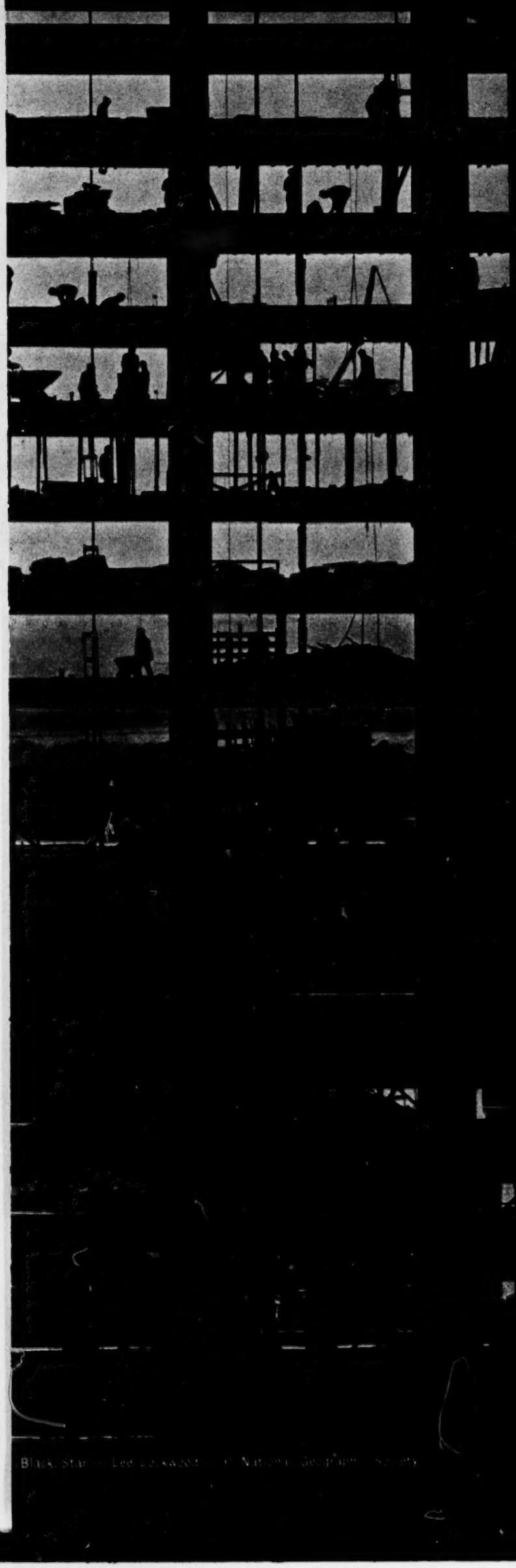
Winfield Parks — © National Geographic Society

Jon Brenneis — Bulletin Magazine — Standard Oil of California

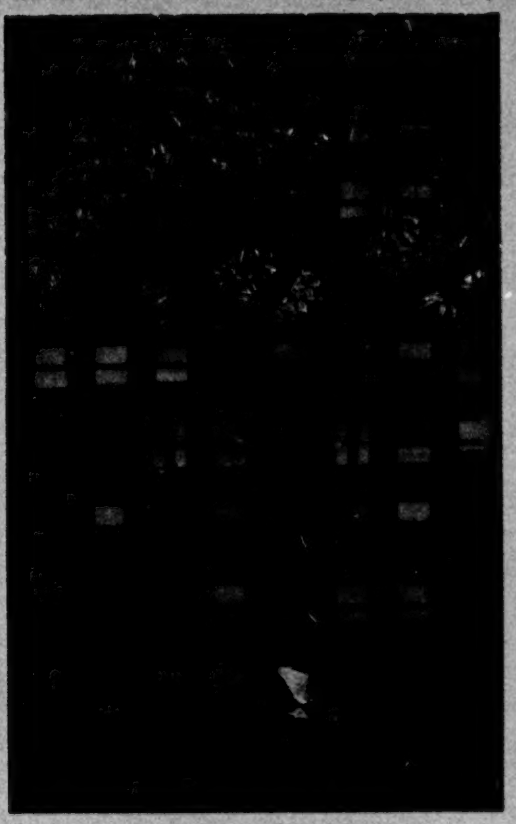
Estuarial water or citrus grove, it matters not what was there before— any place you can hang a house is home.

. . . boxing . . .





Winfield Parks — © National Geographic Society



Steel and concrete lattices like the one at left, eventually form backdrops like this for a lonely tree . . . solitary sentinel left behind by retreating nature.

Black Star — Lee Lockwood — © National Geographic Society

. . . slicing . . .

Jon Brenneis — Bulletin Magazine — Standard Oil of California

22

. . . and

Solving the dilemma between man's needs and his wants is no simple task, but it is one we, as a people, will continue to attempt to resolve as we face each new day.

Congressman Wayne N. Aspinall, Colorado

Jon Brenneis — Bulletin Magazine — Standard Oil of California

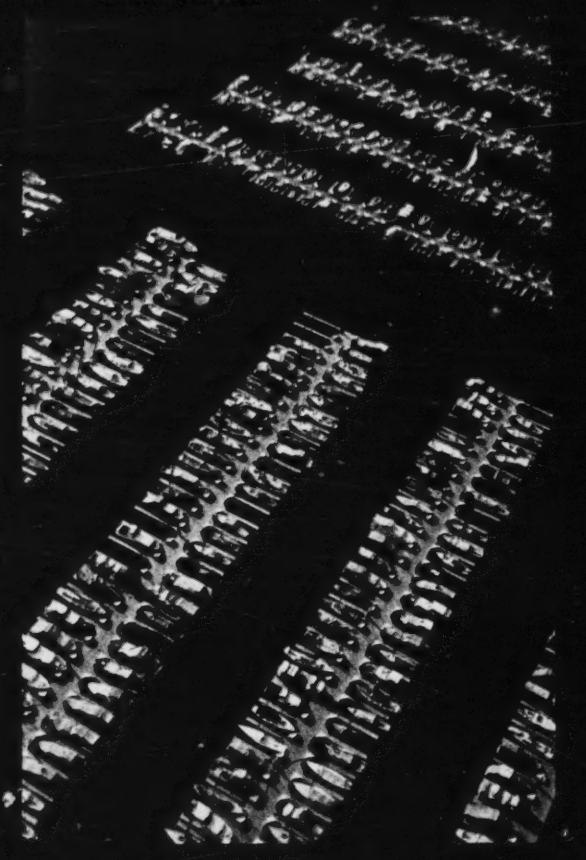
Aerial shots of super highways illustrate dramatically the amount of green open space which has "gone under" in the cause of speed and motion.

worst of all . . .

23

. . . overcrowding his

ners Bulletin Magazine Standard Oil of California



Robert F. Sisson — © National Geographic Society

© National Geographic Society

environment!

Jon Brenneis — Bulletin Magazine — Standard Oil of California

James P. Blair — © National Geographic Society

A POOR PLACE TO LIVE

Abuse of land, air, and water create problems that turn appealing areas into ghettos of ugliness and decay. The illustration immediately to the right tells the story of a watershed area where users of resources have sacrificed their environment for the quick profit—the short-term gain. Follow the keys below to conditions depicted by related keys in the illustration.

1. Lack of Water Control

A rampant stream destroys valuable land, fails to recharge ground water supplies, and jeopardizes lives. Usually it goes through periodic low-water cycles that make it an unreliable source of supply for cities. Not all streams should be dammed, of course, but some must be.

2. Ruinous Forestry Practices

Here, cut-and-get-out logging operations, inadequate fire protection, and other short-sighted actions have led to watershed soil erosion, downstream flooding, and loss of habitat for wildlife. Recreation opportunities are destroyed.

3. Poor Farming Methods

Overuse of land and repeated planting of the same crops, have exhausted the soil's fertility. The absence of contour farming leads to rapid runoff and results in erosion by wind and water.

4. Uncontrolled Growth of Suburbs

Lack of effective zoning and building regulations speeds decay. Open green space is chopped up into inadequate patches. "Bedroom" suburbs like this produce monotony, blight, and high crime rates.

5. Upstream Industrial Pollution

Industries that disregard downstream and downwind pollution degrade the entire watershed. Rural areas often encourage industrial parks without requiring adequate pollution controls.

6. Pollution from Mines

Mining companies abandon underground working without a thought that eventually they will cave in and create surface pockets or feed deadly acid water into streams. Others strip off valuable topsoil and leave ugly scars which add to stream pollution and deterioration of the area.

7. & 9. Faulty Industrial Zoning

Unregulated placing of industry pollutes city's air and water and downgrades value of adjacent property.

8. Improper Waste Disposal

Sewage treatment and waste disposal facilities lag behind population growth, hastening the poisonous suicide of the city.

10. The Polluted River

Pollution the full length of the river has made it an open sewer. Fish cannot live in it, people dislike drinking it even after costly purification. Swimming is impossible, and boating unpleasant.

11. Poorly Managed Traffic

A source of air pollution, frustration, and sudden death, poorly planned traffic facilities—added to substandard mass transportation—strangle the Central City.

12. Trapped by Towers

As the population grows and open space is lost to monstrous high-rise apartments, city dwellers become imprisoned by their own "progress." They live an elbow-to-elbow existence. The more fortunate breathe filtered air at home and at work. Others sneeze and snuffle through smog-filled days and nights.

Prepared by the U.S. Department of the Interior

Which America

Do You Choose?

A GOOD PLACE TO LIVE

The balance of Nature and the quality of man's environment can be maintained in an increas*ingly populous* watershed if sound conservation practices are followed. Some of the benefits are listed below and are keyed to the right half of the illustration.

1. Proper Forestry and Mining

Good forest management means selective cutting, fire protection, and planting new trees. Such practices promote continuing yields of forest products. Strip-mined areas have been re-covered with topsoil. Planting holds the soil in place and keeps streams silt-free.

2. Space to Roam

Wilderness areas are protected, providing assured wildlife habitat, a healthy forest base for the watershed, and outdoor recreation for all.

3. Multipurpose Reservoir

Flood control, power generation, municipal and industrial water supply source, and outdoor recreation facilities are some of the benefits of this reservoir.

4. Farm Land Management

Rotation of crops and grasslands, contour strip planting, wildlife hedgerows, all make this farm flourish while protecting the health and quality of the land.

5. Irrigation

Water provided by a diversion dam and a high-line canal turns normally non-productive land into fertile farms.

6. Industrial Parks

Planning and zoning provide attractive and efficient clustering of industry, to the benefit of both industry and city. Sources of industrial water and air pollution are controlled within the regulated industrial park complex.

7. Fish Hatchery

Hatcheries provide fish to supplement stocks in reservoirs, streams, and lakes.

8. Satellite Communities

Self-contained communities like this offer the services and advantages of close-in suburban living. The beauty of the natural terrain and setting is carefully preserved.

9. Waste Disposal

Efficient sewage plants treat effluents from city systems, keeping the river clean. Refuse is burned to generate power in plants equipped with air pollution abatement devices.

10. The Beautiful City

Careful planning and development provide a beautiful, livable Central City environment. Area-wide master plans control the city's growth, provide a smooth traffic flow, and promote work and living patterns oriented not to technology but to people.

11. & 13. Highways and Rapid Transit

Recessed and underground superhighways, combined with a rapid transit system that extends to the suburban satellite communities, provide efficient movement of people and goods to and from the Central City. With home-to-work rapid transit, private car use is reduced. Combining highway and rapid transit operations uses less open space and requires fewer river crossings.

12. City Park and Recreation Areas

Planned parks like this provide the Central City with large wedges of open space and afford many forms of recreation and cultural facilities for the city dweller.

14. Footpaths and Bicycle Trails

Trails follow the natural terrain of the river banks from city to headwaters.

15. Green Spaces

Through proper planning and zoning, abundant open space in and around the city is preserved. This green space provides a natural source of beauty and recreation opportunities.

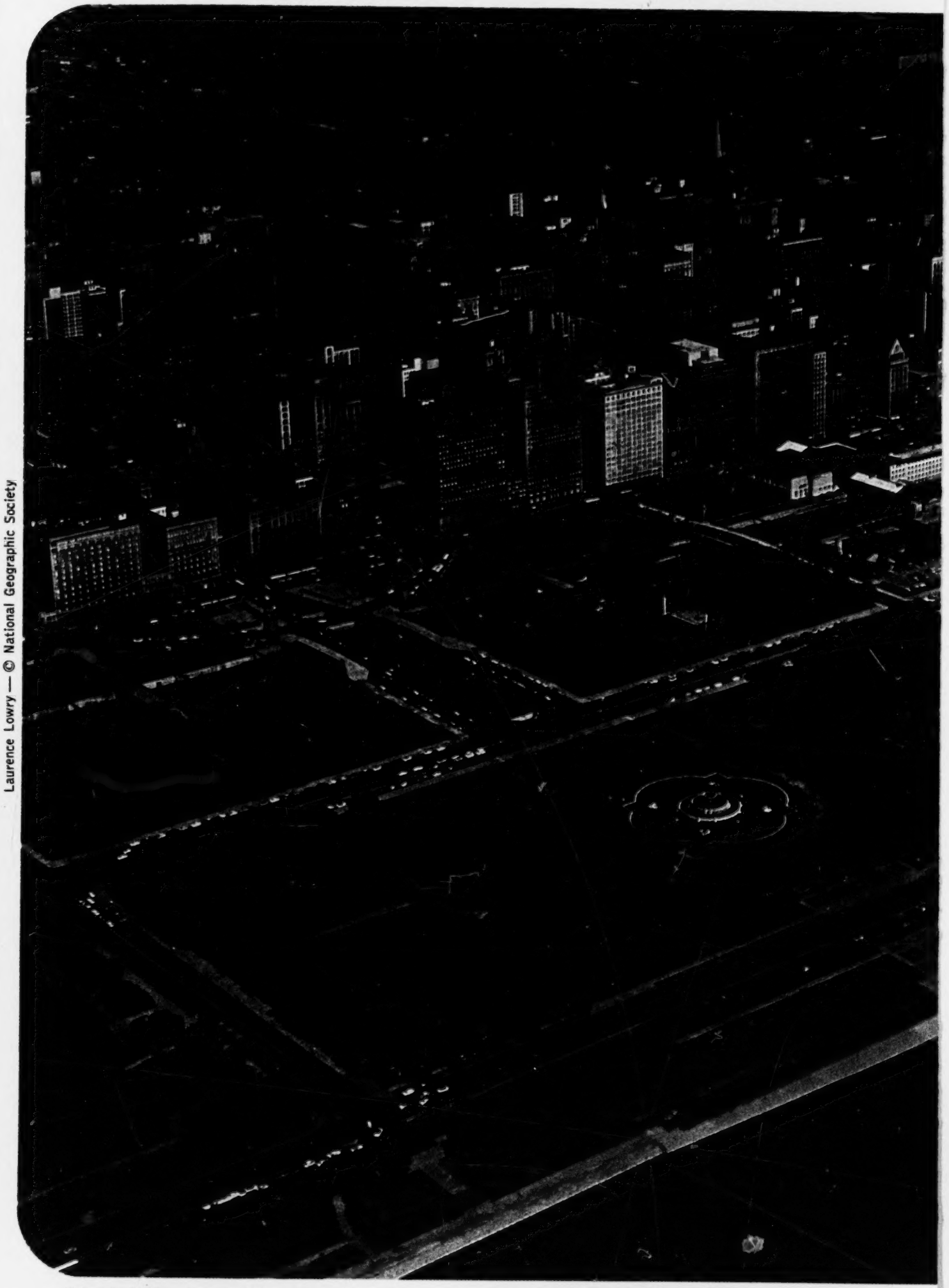
16. The Clean River

Pollution control and good watershed management keep the river clean, making it a recreational delight.

17. Scenic Easements

Scenic easements along river banks protect the natural beauty of the river. Pollution control is made easier and bank erosion prevented. Outdoor recreation opportunities abound in the natural areas preserved.

Man's hand need



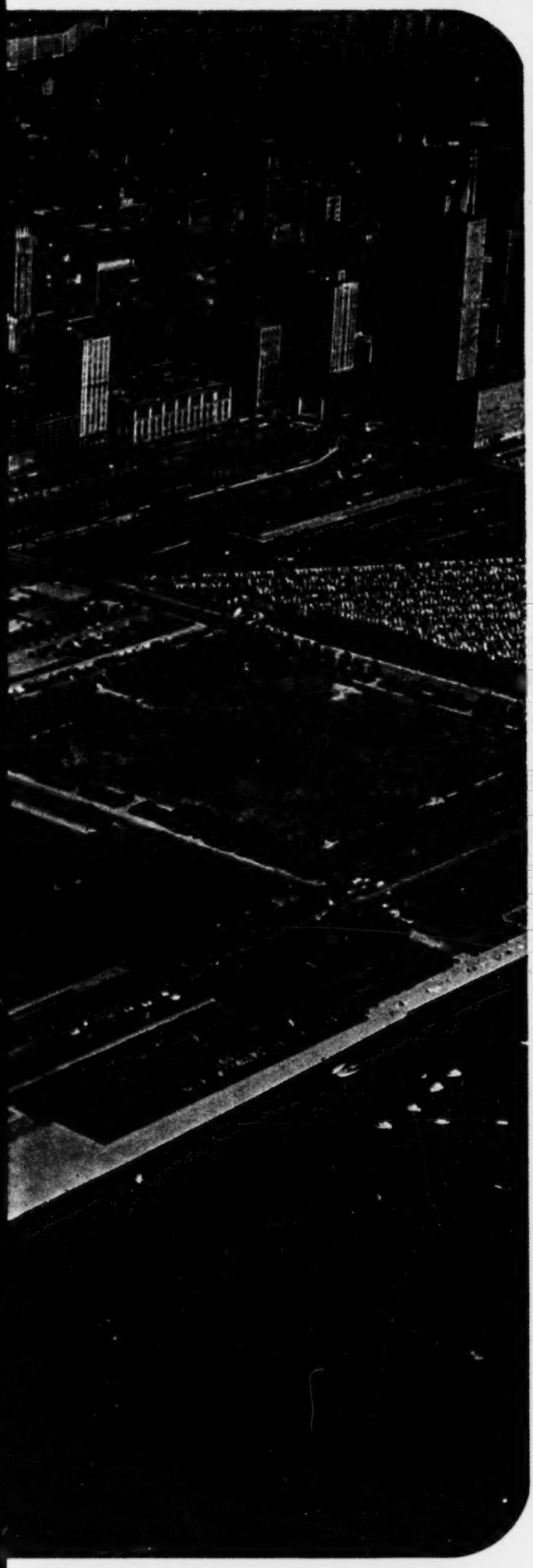
Laurence Lowry — © National Geographic Society

Chicago's fabulous front yard, Grant Park, invites fishermen, boaters, swimmers, and just plain strollers.

The challenge of our age is whether we shall seize the opportunity to decide what kind of life, what kind of environment, and what kind of opportunities we want for ourselves and for our children.

Senator Henry M. Jackson, Washington

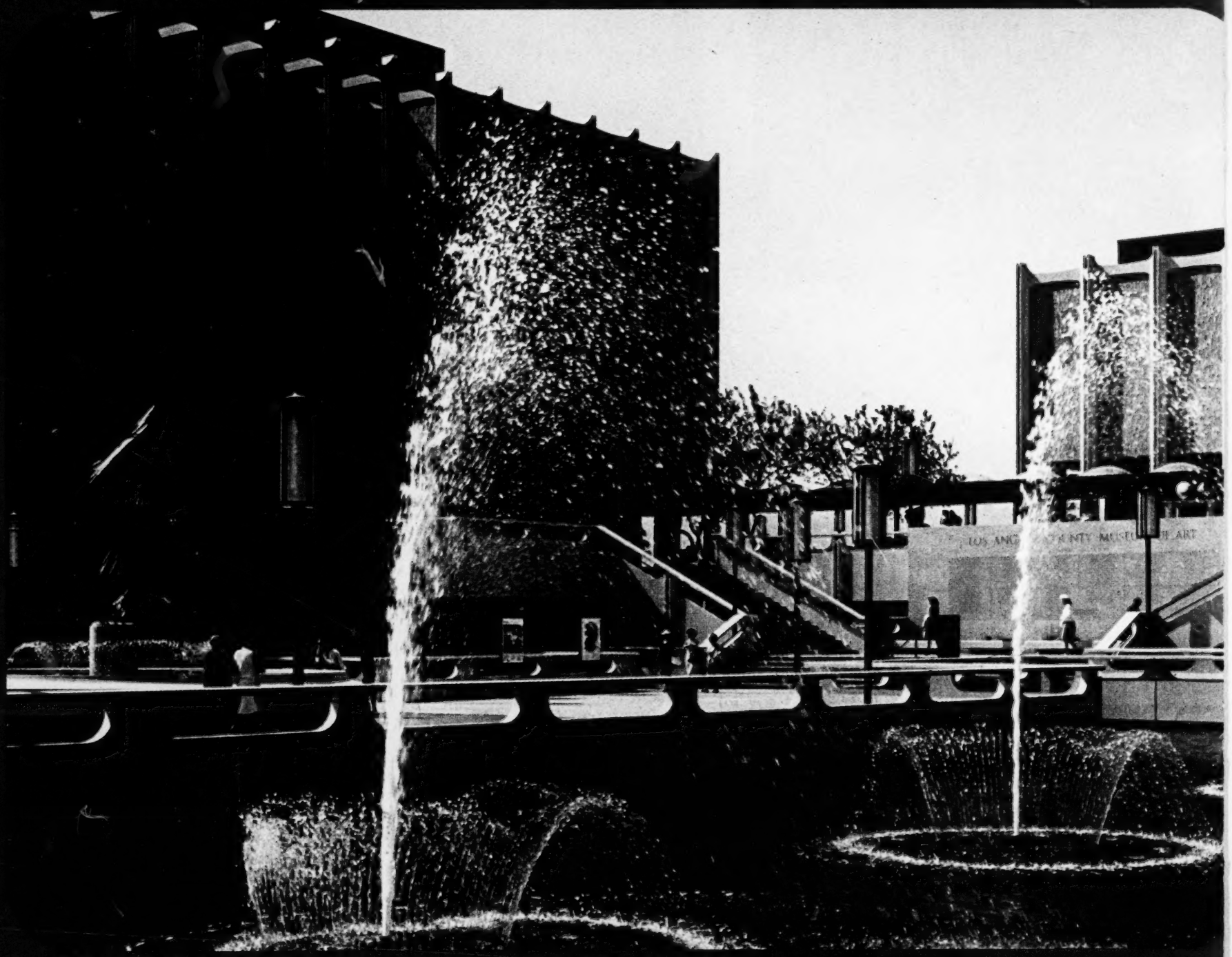
not be heavy . . .



Clyde Hare — © National Geographic Society

Pittsburgh, once shrouded in smoke, now boasts clean air and green urban "lungs," like this.

. . . a new kind of



Reflecting pools and splashing fountains surround the Los Angeles County Museum in Hancock Park.

writing on the wall!

To me, the appealing genius of conservation is that it combines energetic feats of technology . . . with the gentle humility that leaves some corners of nature alone—free of technology—to be a spiritual touchstone and recreation asset.

As I look around at this incredibly beautiful and creative work—it occurs to me that this is a new kind of "writing on the walls"—a kind that says proudly and beautifully, "Man was here."

Mrs. Lyndon B. Johnson
Glen Canyon Dam
dedication address
Page, Arizona, September 22, 1966

Canyon walls, mirrored in the waters of Lake Powell, behind Glen Canyon Dam.

A Geological Survey scientist (standing) connects a voltmeter to the groundwater computer for Kansas and Nebraska, while the oscilloscope (right) shows how

The Endless Task

As the conservation arm of the Federal Government, the Department of the Interior defines its task in terms of the entire planet. From recreation to reclamation, from minerals to mallards, from water to wilderness, the various programs within the Department must meet specific problems and still mesh with other efforts—efforts to preserve our historic past, to stretch our natural resource potential, to restore and beautify and enhance our overall environment.

The pages that follow contain the highlights of one

far water table will fall in 50 years. Scientist at left draws a water-table contour map from such spot readings.

year's conservation effort, as conceived and carried out by the men and women of the Department of the Interior.

Water Pollution Control Administration

Long stretches of most American rivers, particularly those in heavily populated areas, are shamefully dirty.

The Merrimack, on which the earliest textile mills were built, has turned filthy brown and bubbles like soda pop with nauseating gases.

Along the lower reaches of the Mississippi, queen of the Nation's rivers, millions of fish turned belly up and died each winter for 4 consecutive years.

On the Hudson, near Troy, N.Y., scavenger eels—about the only thing that can live in waters befouled by raw sewage—cling to wastes and attack sanitary engineers taking samples.

The Missouri sometimes flows red with blood from slaughterhouses, and carries grease balls almost as big as footballs.

The Mahoning, a workhorse river for industrial Pennsyl-

vania and Ohio, is rust-colored from the "pickle liquor" of steel mills and is topped off with debris-strewn scum.

Most beaches on the Great Lakes, largest bodies of fresh water in the world, are closed to swimmers.

The list is long and depressing.

It represents an alarming condition, not merely because polluted water insults both the eye and nose and prevents healthful recreation, but because in a densely populated, urbanized, and industrialized America the use of rivers and streams, lakes and bays solely for the transport of wastes, is no longer feasible. There are too many other uses for these waterways—particularly for municipal water supply, industrial water supply, and irrigation.

It was a situation that crept silently and insidiously upon the American people. Only a small group of gallant conservationists was alarmed and fought to preserve the beauty of American streams. Since the use of chemicals to kill bacteria had virtually eliminated cholera and typhoid epidemics, most people remained complacent.

But slowly public indignation became aroused. It is increasing at a faster pace each year. It surged to new heights during the past year.

This public concern manifested itself in the number of news and feature articles published in major periodicals; in action by community organizations; in increased construction of waste treatment plants; in the approval by New York State of a $1.7 billion program to combat water pollution; and in the passage of the Federal Water Quality Act of 1965 which added many activities to the existing Federal program, strengthened others, and continued almost all remaining activities. Other Federal legislation established an interagency Water Resources Council and enabled the Departments of Commerce, Agriculture, and Housing and Urban Development to provide or increase their assistance to communities for water supply and waste disposal systems.

Many predict that public sentiment against the abuse of the Nation's water resources is likely to lead to even more vigorous measures during the next few years. Establishment on January 1, 1966, of a Water Pollution Control Administration was followed only 4 months later by its transfer from the Department of Health, Education, and Welfare, to the Department of the Interior. It was agreed that the Administration would be a logical companion for such Department of the Interior agencies as the Bureau of Sport Fisheries and Wildlife, the Bureau of Commercial Fisheries, the Geological Survey, the Office of Water Resources Research, the Bureau of Reclamation, the Office of Saline Water, and the Bureau of Mines.

In 1966 Congress enacted far-reaching legislation to speed the move against water pollution. The legislation: Authorizes greatly increased appropriations for Federal grants to construct municipal waste-treatment facilities; establishes a "clean rivers restoration" program; finances stepped-up research; doubles the amount of Federal support available to State and interstate water pollution control agencies to strengthen their own programs; and improves many other phases of the national effort.

This trend was not new. Constant expansion has characterized the Federal role in combating water pollution ever since passage in 1948 of the first experimental Federal legislation dealing with that subject. The basis for the present program was established in 1956, when the first permanent Federal Water Pollution Control Act placed responsibility for the program in the hands of the Surgeon General of the Public Health Service under the supervision and direction of the Secretary of Health, Education, and Welfare (instead of the Federal Security Administration). The Act:

Authorized Federal grants of $50 million for the construction of municipal sewage treatment works (but no single project was to receive more than $250,000);

Authorized $3 million a year to strengthen activities of State and interstate water pollution control agencies;

Authorized continued Federal-State cooperation in the development of comprehensive programs for controlling water pollution;

Authorized increased technical assistance to States; research and training grants to universities; collection and dissemination of basic data on water quality in United States rivers, streams, lakes, and bays;

Modified and simplified procedures concerning Federal abatement actions against interstate pollution; and

Authorized a cooperative program to control pollution from Federal installations.

In 1961, Congress approved amendments which strengthened and improved the Act by:

Designating the Secretary of Health, Education, and Welfare to administer the Act;

Increasing amounts authorized for municipal construction grants to $80 million in 1962; $90 million in 1963, and $100 million for each of the following 4 years; and raising the single grant limitation to $600,000, and to $2.4 million for multimunicipal projects;

Raising annual appropriations for strengthening State and interstate programs to $5 million;

Broadening enforcement authority to cover navigable as well as interstate waters; and extending authority to instances of intrastate pollution at the request of a Governor;

Intensifying research by authorizing annual appropriations for this purpose of $5 million and by authorizing the establishment of 7 field laboratories (later increased to 10 field laboratories and 2 national water quality laboratories).

Authorizing the inclusion of storage for purposes of water quality control in the planning of Federal reservoirs or impoundments.

Hardly had this law been passed when Congress began a new series of actions. On October 2, 1965, President Johnson signed new legislation called the Federal Water Quality Act of 1965. Following is a description of its provisions and why they were adopted.

From January 1957 through June 1966, the Federal Government held 37 enforcement conferences in efforts to curb water pollution. Among the waters affected are Lake Michigan, Lake Erie, the Hudson River, Puget Sound, many stretches of the Mississippi and Missouri Rivers, the Detroit River, and the Colorado.

The program has covered 8,000 miles of streams, not including ocean, bay, and lake waters. It has involved about 1,200 different municipalities and about the same number of industrial establishments. Forty-one States plus the District

of Columbia and four interstate agencies have been parties to the enforcement cases.

The Secretary of Interior can start Federal enforcement actions against pollution when:

> The pollution is on an interstate body of water, its effects are felt in a State other than the one in which the discharges originate, and the effects are damaging to health or welfare; and
>
> The pollution involves interstate or navigable waters, damage to health or welfare is occurring, and the Secretary is requested by the Governor of an affected State to take enforcement action.

The Water Quality Act of 1965 added two other instances when enforcement can be undertaken.

The first is when pollution of any interstate or navigable waters has damaged shellfish so that substantial economic injury has resulted from the inability to market shellfish or shellfish products in interstate commerce.

The reasoning behind this provision lies in the fact that, over the years, the Federal and State Governments have developed effective barriers to the transportation and sale in interstate commerce of shellfish, such as clams, oysters, and mussels, which do not meet approved sanitary standards. But enforcement of these regulations has often worked economic hardship on persons involved in gathering and harvesting operations. They have no direct recourse against polluters, and measures to clean up the waters were often ineffective. Congress decided, therefore, to make Federal enforcement powers available to abate pollution in these waters and to allow restorative measures to proceed more promptly and effectively.

The second instance is when water quality in interstate waters or portions thereof has been reduced below the level set as a standard by State or Federal action in compliance with the 1965 legislation. That is, once the States have set the water quality criteria required by the new amendments, and the Secretary has found them acceptable, any violation of them is subject to abatement by enforcement action.

In drafting the new bill, it was this provision concerning water quality standards that created the most controversy. There was broad agreement that constant effort to improve the quality of the water supply was necessary to make water available for more uses; that water quality standards provided reliable and sound guidelines, and provided a basis for preventive action; and that such standards enabled municipalities and industries to develop realistic plans for new plants or expanded facilities without uncertainties about waste disposal requirements on interstate waters. The issue was: Who would establish the standards and enforce them?

As worked out, the new law provides authority for the Secretary of the Interior to establish standards of water quality to be applicable to interstate waters or portions thereof, in the absence of effective State action. The standards are to be formulated in accordance with accepted administrative procedures calling for notice, public hearing, and consultation with affected public and private interests. The standards would be subject to revision either by the Secretary on his own or when petitioned to do so by the Governor of any affected State.

The conference committee of the House and the Senate

Finally — and regrettably quite late — an awareness that the entire nation faces a severe water management problem has penetrated the national conscience.

Senator Clinton P. Anderson, New Mexico

WATER FUNCTIONS AND RESPONSIBILITIES OF THE DEPARTMENT OF THE INTERIOR

OFFICE OF WATER RESOURCES RESEARCH

- Grant-in-aid for state water research
- Training water scientists

GEOLOGICAL SURVEY

- Surface water and ground water information on:
  - Sources
  - Distribution
  - Quantity
  - Movement
  - Quality
  - Availability

BUREAU OF OUTDOOR RECREATION

- Land and Water Conservation Fund
- State and national recreation planning
- National Wild Rivers System

BUREAU OF RECLAMATION

- Multiple-purpose water development:
  - Planning
  - Operation
  - Construction
- Small projects loan program
- Water conservation research:
  - Reservoir evaporation losses
  - Irrigation drainage salinity control
  - Weather modification

BUREAU OF COMMERCIAL FISHERIES

- Enhancement of commercial fisheries resource
- Commercial fish and water storage dams
- Effects of pollution on coastal fish and shellfish

BUREAU OF INDIAN AFFAIRS

- Manages water resources of Indian reservations

WATER POLLUTION CONTROL ADMINISTRATION

- Pollution abatement technology
- Promulgation of water-quality standards
- Enforcement of water-quality standards
- Grant program for treatment-plant construction
- River basin pollution control survey and planning

BUREAU OF SPORT FISHERIES AND WILDLIFE

- Migratory waterfowl management
- Water pollution effects on fish
- Pesticides effects on aquatic habitats
- Enhancement of sport fisheries resource

NATIONAL PARK SERVICE

- National Scenic Riverways
- National Recreation Areas

OFFICE OF SALINE WATER

- Water desalting research and development
- Final renovation of waste water treatment effluents

BUREAU OF MINES

- Research on pollution from:
  - Acid-water mine drainage
  - Strip-mined land

BUREAU OF LAND MANAGEMENT

- Manages water resources of public lands

POTOMAC RIVER STUDIES

- Comprehensive Conservation Programs

stressed voluntary compliance and the avoidance of court action. It is the purpose of water quality standards to provide agencies with additional tools for making objective and clear public policy statements on the use or uses to which specific segments of interstate waters may be put. The principal objective is the orderly development and improvement of the Nation's water resources. The standards are not designed to "lock in" present uses of water or to exclude other uses not now possible. Nor are they a device to insure the lowest common denominator of water quality; rather their purpose is to enhance the quality and productivity of America's water resources.

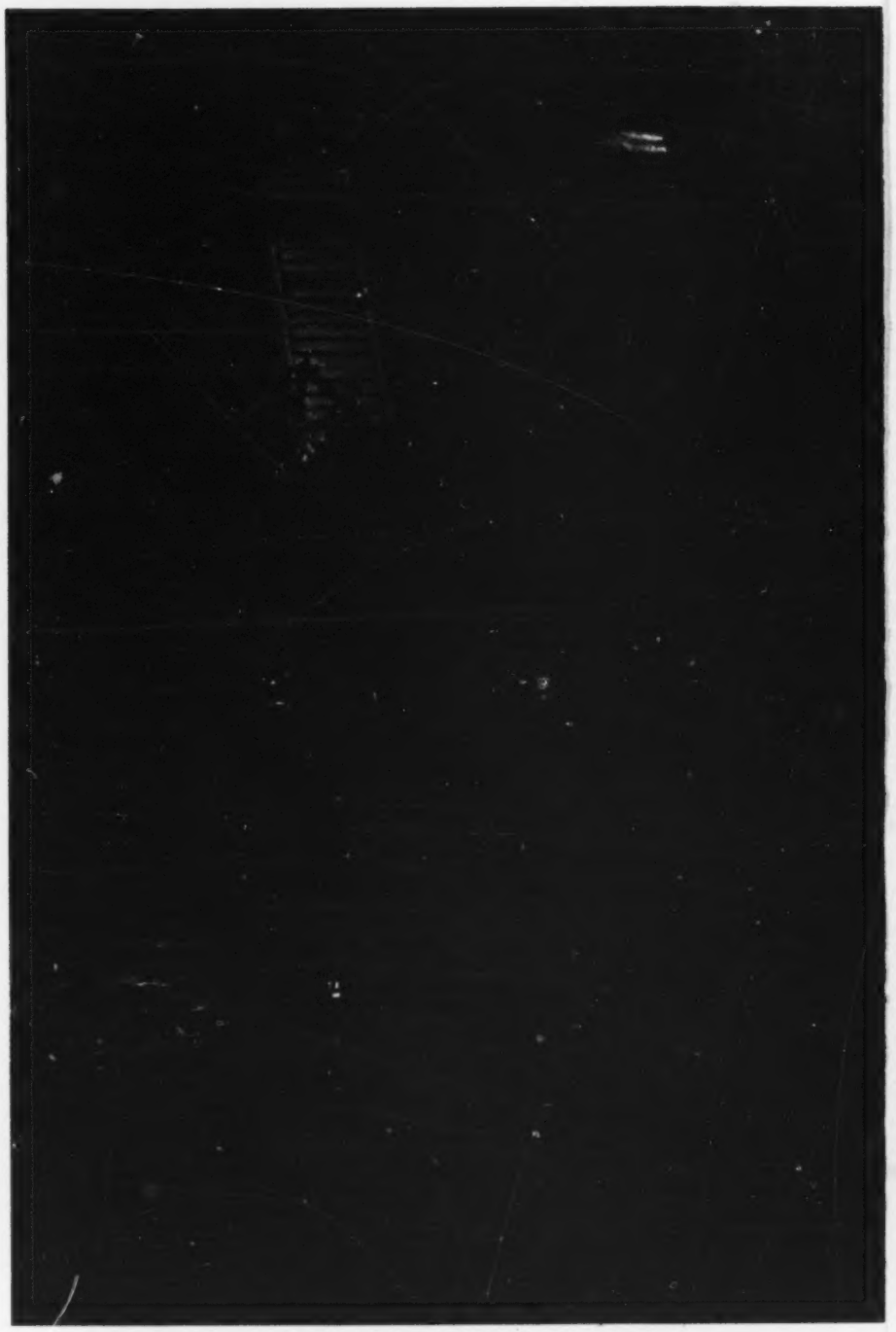
The standards provision of the new Act is particularly significant. First, it encourages compliance with pollution control requirements by letting conscientious water users know what is expected of them. In addition, it gives the Federal Government authority to prevent pollution instead of instituting enforcement action after proving that pollution is endangering health or welfare. It should be of substantial help in preserving the quality of relatively clean waters, and in progressively restoring polluted waters to a degree of reasonable purity.

Once the standards have been established, any discharge of matter which reduces the quality of water below the standards is subject to existing enforcement procedures. They follow:

Conference. A conference is called by the Secretary of Interior, either on his own initiative, when he has reason to believe that damaging interstate pollution exists, or at the request of the Governor or water pollution control agency of any State. The conference is a meeting of representatives of each of the State water pollution control agencies concerned, a representative of the Department of the Interior, and a Chairman appointed by the Secretary of the Interior. The conference is not an adversary proceeding. Rather, the conferees each report their views on the pollution situation and attempt to formulate unanimous recommendations for remedial action. The Secretary of the Interior must, by law, issue his own recommendations following an enforcement conference. The Secretary has, in fact, always accepted the conferees' recommendations when they were unanimous.

Hearing. If, at least 6 months after the conference recommendations have been issued, they have not been complied with, the Secretary calls a public hearing before a hearing board of five or more persons he has appointed. The hearing board takes sworn testimony from witnesses who are subject to cross-examination. The alleged polluters are now made direct participants. On the basis of the evidence presented, the hearing board makes its findings and recommendations for pollution abatement. The findings and recommendations are sent by the Secretary to the alleged polluters together with a notice specifying a reasonable time, not less than 6 months, in which action must be taken to abate the pollution.

Court Action. If there is no compliance with the hearing recommendations after at least 6 months, the Secretary may request the Attorney General of the United States to bring suit on behalf of the United States to obtain abatement of pollution. In an intrastate case, the written consent of the Governor is required to proceed to this step.

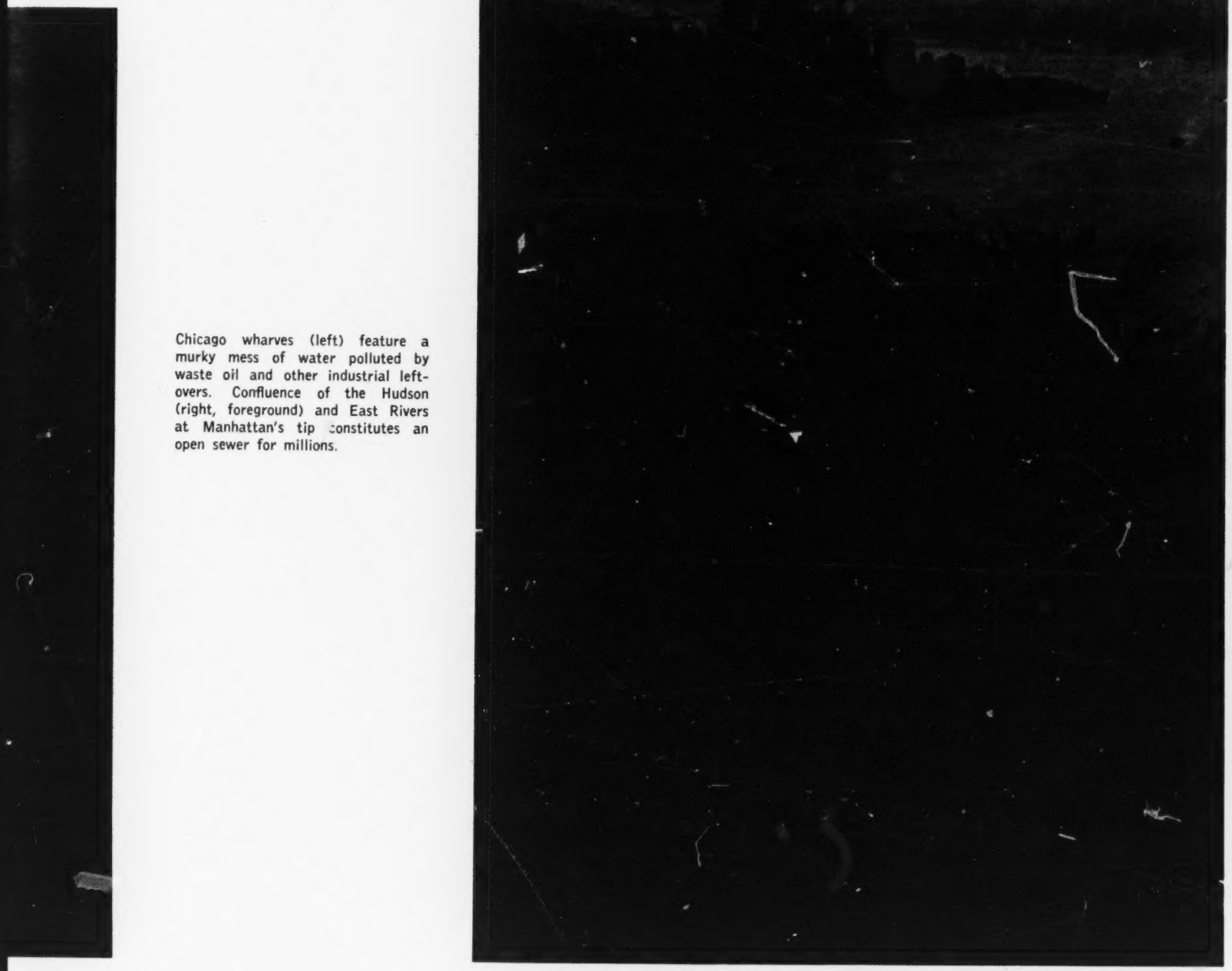


Public Health Service — The National Observer — Dow Jones & Co., Inc.

The emphasis is on the first stage of enforcement, the conference. Of the 37 enforcement cases since 1956, only 4 have gone to the second stage, a hearing, and only one to the final stage, court action. The Administration hopes to perpetuate the record, since it believes that cases are settled at the conference table more rapidly, more amicably, and with more promise of permanent improvement in the treatment of the Nation's water resources than through court hearings.

Because of the depression of the 1930's and the interruptions of World War II, municipal construction of waste treatment facilities fell far behind the needs. The astonishing growth of population and industry during the postwar era aggravated the situation. To help solve the problem, the Federal Government began offering grants to municipalities to aid construction, enlargement, or modernization of their waste treatment facilities.

Nevertheless, construction did not reach the level necessary to bring the municipal waste pollution problem under control.



MAGNUM — Wayne Miller — Newsbook, "America Outdoors" The National Observer — Dow Jones & Co., Inc.

Chicago wharves (left) feature a murky mess of water polluted by waste oil and other industrial left-overs. Confluence of the Hudson (right, foreground) and East Rivers at Manhattan's tip constitutes an open sewer for millions.

According to a recent survey, 1,342 communities are still discharging raw sewage from a combined population of 11 million. An additional 1,337 cities and towns require new or enlarged facilities for their population of 17 million. And 2,598 unsewered communities require sewer systems and sewage treatment plants for a population of 5.1 million. Many municipal waste treatment works now operating must be replaced because of obsolescence.

Elimination of the backlog, replacement of obsolete treatment works, and provision for continuing population growth will require an average annual expenditure of over $800 million for municipal waste treatment works for the rest of this decade. With allowance for rising construction costs, the figure increases to $865 million.

During the hearings on proposed Federal legislation, spirited pleas were made for giving larger cities a greater share of the construction grants. Congressional committees were told that the assistance received by the larger cities from Federal construction grants was not proving an effective incentive in view of their larger expenses. About 45 percent of the people whose needs for waste treatment facilities are still unmet are found in these large communities. In writing the Water Quality Act of 1965, Congress responded by:

Increasing from $100 million to $150 million the annual authorization for appropriations for fiscal years 1966 and 1967, the remaining 2 years for which Federal waste treatment works construction grants are authorized;

Doubling the maximum amount for a single project from $600,000 to $1.2 million;

Doubling the maximum amount for a multimunicipal project from $2.4 million to $4.8 million;

Making the additional $50 million available to States on a straight population basis, rather than a population-per capita income basis; with these additional funds the Federal grant may amount to the full 30 percent of the project cost if the State matches equally all Federal grants from its allocation.

Two other actions were taken to meet primarily metropolitan needs. The Congress voted that grants may be increased by 10 percent if a project is certified by a metropolitan or regional planning agency as conforming with a comprehensive metropolitan area plan.

Wise management must guide our efforts to meet increasing water demands

Painting by Caterpillar Tractor Co.

The thinking of the Senate committee (S. Rep. No. 556, 88th Cong., 1st Sess.) was that such planning "had become no less than essential in view of our rapid urbanization * * * Orderly development of municipal areas must be planned and followed to eliminate factors which lead to the breeding of slum- and blight-impacted areas and to effect those sizable economies and efficiences ordinarily made possible through the coordination of common interests and needs."

From the beginning of the program in 1956 to the end of June 1966 (last quarter projected), nearly 7,000 projects had been approved for Federal grants of $775 million. Local communities contributed an additional $2,875 million to meet the total project cost of $3,650 million. Approved projects will serve 58 million people and improve the quality of water in 59,000 miles of stream.

The Water Quality Act of 1965 launched the first serious effort to deal with a special type of pollution caused by combined storm and sanitary sewers in many of the Nation's older municipalities. During periods of storm runoff, even from small rainfalls, the sewers discharge flows of storm water and untreated sewage in excess of the capacity of treatment plants. As a result, much untreated sewage is bypassed into receiving waters, creating a situation that is often worse than if all storm water runoff were discharged into receiving waters in an untreated state.

Congress acted on information that there were more than 1,100 communities whose entire waste collection systems were of the combined sewer type. These sewers were serving a population of almost 21 million people. Another 810 cities of 37.8 million population had systems which consisted in part of combined sewers.

Complete separation of combined systems would entail expenditures of some $30 billion. At committee hearings many witnesses suggested that research and development grants be authorized to demonstrate new or improved methods to eradicate this problem. Congress responded by establishing a program of demonstration grants and contract authority designed to explore methods of averting such huge expenditures. Annual appropriations of $20 million for fiscal years 1966 through 1969 were authorized.

Public agencies can qualify for grants; public and private agencies, for contracts. The first grant, made in May 1966,

It starts with a raindrop up in the mountains (2) and ends in a river or sea at lower right in the picture (14). In between to control and store our water supply, we need to replant forests (1) and grasslands (3) to hold back the rainfall and release it slowly to streams or underground reserves. Contour plowing and terracing (5) and diversion terraces and waterways (4) help prevent excess water from eroding valuable topsoil. Farm ponds (7) collect and store water for a dry period. All these projects help prevent springtime flooding of river communities (6). Multipurpose dams downstream (10) and levees (11) also control excess runoff and prevent floods. Result: farmers have water to irrigate their crops (8). Industry has water for production (12). Inland navigation becomes practical (13). We all enjoy more recreational facilities (9).

was for $870,750 and was awarded to the Minneapolis-St. Paul sanitary district to demonstrate the more efficient use of existing storage capacity of sewer systems so that wastes can be stored for later treatment after storm waters recede.

In recent years the growth and concentration of population and industry, the development of new products, and changing land uses and practices have revealed an enormous gap between the technology for creating goods and our technology for disposing of the wastes incurred in their manufacture.

Present technology in water pollution control falls short in these respects:

Removal of oxygen-demanding contaminants from waste effluents beyond the present 90 percent efficiency;

Renovation of effluents to produce water suitable for direct, deliberate reuse;

Abatement of pollution from acid mine drainage;

Control of pollution from irrigation return flows;

Treatment and control of storm and combined sewer discharges;

Retardation or reversal of eutrophication. (Eutrophication arises from over-fertilization of water which induces nuisance vegetation and leads to premature aging of the water); and

Prevention of ground water pollution by salt water intrusion.

A principal instrument now being developed by the administration for solving many of these problems is called "advanced waste treatment." It aims to reduce the level of pollution of the Nation's water resources by permitting repeated downstream water uses; and to renovate waste waters for direct and deliberate reuse for agricultural, industrial, recreational, and even municipal purposes.

To succeed, the technical program must be able to produce a purified effluent of a quality suitable for reuse, to concentrate the impurities in the water into small volumes, and to provide for ultimate, nonpollutional disposal of this concentrate.

Development of a successful advanced waste treatment technology could lead, in one giant step, to alleviating both water pollution and water supply problems. Furthermore, it could dramatically reduce the present and projected huge volumes of streamflow regulation water which would otherwise be required to dilute presently untreatable wastes.

During the past 5 years, a range of potential advanced waste treatment processes has been explored. Some processes have been rejected for either technical or economic reasons. Still others have proved so promising, both from the cost and performance standpoints, that they have already been carried from the laboratory to the pilot scale and even to the field evaluation phase. These "leading" contenders are foam separation, coagulation-solids removal, granular carbon adsorption, and electrodialysis.

The cost of accomplishing such purification per 1,000 gallons, on the basis of an operation that treats 10 to 20 million gallons per day (m.g.d.), are: Foam separation, 2 cents; coagulation-solids removal, 4 to 8 cents; adsorption, 14 to 18 cents; electrodialysis, 40 to 50 cents.

These costs would be in addition to the roughly 10 cents per 1,000 gallon cost of conventional primary and secondary treatment. These are "conservatively high" figures based on bench and pilot plant studies thus far. The more optimistic cost projections and the goals which the continuing research and development program are attempting to achieve are significantly lower.

To the present, two 500,000 gallons per day (g.p.d.) pilot foam separators have been constructed and operated; at year's end, the coagulation-solids removal process was being piloted at 15,000 g.p.d.; and a 300,000 g.p.d. adsorption pilot plant was going into operation, as was a 75,000 g.p.d. electrodialysis unit. These pilot facilities, designed to obtain realistic performance and cost data in the field plus actual full-scale application of some of the processes, were being developed at several locations—Whittier Narrows, San Ramon Village, and Lake Tahoe, all in California; Lebanon, Ohio; and the District of Columbia.

Most of the work needed to convert current laboratory processes to engineering realities can be accomplished in the next 10 years. New Federal Water Pollution Control laboratories authorized in 1961 and subsequent years will play an important role in this program.

During fiscal 1966, field laboratories at College, Alaska; Ada, Okla.; and Athens, Ga., were completed. Laboratories at Corvallis, Oreg.; Ann Arbor, Mich.; Boston, Mass.; and Baltimore, Md., should be completed in the next few years. In the drafting stage are laboratories at Stevens Point, Wis.; Columbia, Mo.; and Vicksburg, Miss.

In addition to these regional laboratories, two national laboratories will conduct research in water quality standards. The one for fresh-water standards is to be at Duluth, Minn., and the one for salt water at Narragansett, R.I. These laboratories will seek to determine the quality requirements for all water uses, with a high priority for the requirements for aquatic life, both fresh water and marine.

During the year, the Federal Water Pollution Control Administration began comprehensive projects for water pollution control of two major drainage systems of the United States: The Central Pacific Rivers and the Missouri-Souris-Red Rivers. These will bring to nine the number of such projects in progress: One—the Arkansas-Red River Basins project—has been completed.

These projects exemplify the new dimensions in conservation. They represent, in President Johnson's words: "A new conservation: to restore as well as to protect * * * to handle the waste products of technology as well as the waste of natural resources."

They represent as well the river basin approach to water resources which, under joint Federal-State sponsorship, takes in pollution abatement, reuse of water, multiple use of water, enhancement of fish and wildlife habitat, provision of recreation facilities, control of flood damage, and all the many other environmental factors involved.

Going far beyond earlier investigations, these comprehensive projects begin by seeking answers to such questions as:

How much water is available and what is it being used for? What are the sources and nature of the pollution? How good is the water and how are present uses affecting it? What will be the water demands and resultant waste loadings in 20 or 50 years? What is required to make the used water reusable? How much will the necessary pollution control measures cost, and how soon can they be implemented?

Using a wide range of engineering and scientific disciplines, the program then proceeds to offer recommendations, and alternatives, on such matters as sewage treatment needs, master planning for integrated systems, the amount of storage needed for diluting and assimilating wastes, stream monitoring, and numerous other measures required to achieve acceptable levels of water quality.

The locations of these projects, with dates of inception (fiscal years) and completion, are: Arkansas-Red Rivers Basins, 1958–63; Great Lakes-Illinois River Basin, 1961–70; Columbia River Basin, 1961–67; Chesapeake Bay-Susquehanna River Basin, 1961–69; Ohio River Basin, 1963–71; Southeastern River Basins, 1964–69; Hudson-Champlain and Metropolitan Coastal Areas, 1965–71; Delaware River Estuary, 1962–67; Missouri-Souris-Red Rivers Basin, 1966–72; and Central Pacific River Basins, 1966–72.

During the year, significant progress was made on many other fronts. Sampling stations supervised by the Water Quality Surveillance System reached 131. In April 1966, the switch was turned to feed data from three automatic monitors on the Potomac River to an electronic computer in the national headquarters building. By 1968, the number of monitors on the Potomac will increase to 10.

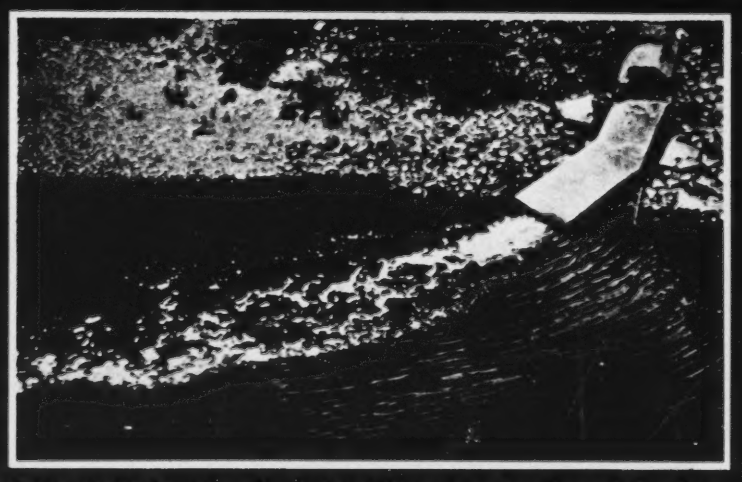
In cooperation with State agencies and the Bureau of Mines, several demonstration projects were launched to find ways of eliminating acid mine drainage, a notorious spoiler of waters in Appalachia and elsewhere.

Research grants and fellowships to universities and other research institutions are increasing each year. Designed to encourage investigation in neglected areas of water resource management, they numbered 430 for the year ended June 30, 1965, and cost $8,921,000. In fiscal year 1966, grants and fellowships numbered 489. Cost was $11,420,000.

During the year, 30 reports on the amount of storage needed for streamflow regulation to maintain water quality were prepared. These figures are required by the U.S. Army Corps of Engineers and the Bureau of Reclamation in connection with building Federal dams and other impoundments. This function, and various health functions relating to water pollution control, remain within the jurisdiction of the Department of Health, Education, and Welfare.

Technical assistance was given to hundreds of communities and industries which encountered difficult or complex problems

Suds and sewage, blood and acid—a few of the effluents we pour into our long-suffering waterways. Above, a steel retaining wall is corroded by acid wastes. Below, slaughterhouse outpourings redden a ditch. Above, right, detergents that survived a sewage treatment plant, bubble off to upset aquatic life balance. Below right, domestic sewage and storm runoff carry refuse into Missouri River.



Public Health Service — The National Observer — Dow Jones & Co., Inc.

of water supply and waste disposal. One of these projects received much publicity when it uncovered the pesticide endrin as the cause of recurrent, multimillion fish kills in the lower Mississippi River. Another interesting project seeks to trace the effects of pesticides and other agricultural chemicals on the life cycle and well-being of fish and wildlife in the Klamath River Basin of Oregon and California.

Office of Water Resources Research

The Office of Water Resources Research (OWRR), which administers the Water Resources Research Act of 1964, is employing an approach similar to that used in the cooperative Federal-State agricultural experiment station program.

The Water Resources Research Act authorizes continuing annual allotments to an approved water research institute in each State and the Commonwealth of Puerto Rico for research and training. But in addition, it provides other type arrangements aimed at using all possible means—brainpower, equipment, facilities, and funds from various sources—in tackling complex water problems.

One avenue is through projects submitted by the 51 institutes in which Federal funds are matched at least dollar for dollar by State or other non-Federal sources. Often these matching grant projects, as well as the annual allotment projects, involve research conducted by personnel at other universities with which the institutes cooperate to mount the strongest possible interdisciplinary program. Thus, the State university at which the institute is located may have outstanding competence in engineering and biology, and other universities in the State may have exceptional capability in research on water law or socioeconomic aspects of water problems. By pooling their resources, these institutions establish a most effective research approach in solving water problems of importance to the State or the Nation.

The act also authorizes the Department to provide financial support to any institution, foundation, private firm, public agency, or individual competent to do research on any aspect of water problems related to the mission of the Department which is deemed desirable and is not otherwise being studied. This support may be in the form of grants, various types of matching grants, contracts, or other cooperative arrangements.

The Nation's science and engineering capability in the water resources field is being strengthened through this program by enlarging of trained staff, acquisition of supplies and equipment, and exchange of scientific information.

During fiscal 1966, hundreds of students were employed as research assistants on approved projects, and by working under the supervision of the well-qualified principal investigators, received valuable training in the water resources field.

In the brief time since the Office of Water Resources Research was established, a *Water Resources Research Catalog*, describing more than 2,000 current research projects, was published so that researchers throughout the country can tell what is being studied and thus avoid duplication of research effort. A *Bibliography on the Socio-Economic Aspects of Water Resources* and a *Water Resources Thesaurus*, or list of indexing terms, also were prepared as information retrieval aids in this wide ranging field.

Geological Survey

Man historically has looked to his reserves in time of need, be they a military unit in the field, cash in the bank, or natural resources. Accordingly, such reserves must be safeguarded for contingencies, and used wisely.

So it is with ground water, water stored in rocks beneath the earth's surface. Hydrologists of the Geological Survey have computed that within one-half mile beneath the land surface of the 48 contiguous States are some 53,000 cubic miles of available ground water, nearly all of which is satisfactory for human consumption. An idea of the amount can be gained when one realizes that a single cubic mile of water contains more than a trillion gallons.

The ground water lying closest to the surface has been tapped increasingly in recent years. In some areas, heavy pumping has lowered water levels to near-critical points so that supplies are insufficient to meet growing demands related to municipal growth and economic expansion.

Because the trillions of gallons of underground water cannot be drawn upon indefinitely at presently increasing rates, Geological Survey hydrologists are working on the conservation of surface supplies while simultaneously keeping a close inventory of subsurface supplies.

They have developed a "harvest" technique which permits collections of substantial amounts of rainwater that otherwise would evaporate after just wetting the soil. Experiments at White Sands, N. Mex., in cooperation with the U.S. Army and a research firm, demonstrated the feasibility of waterproofing plots of ground with an asphaltic spray. Water collected from the sprayed plots can be used directly for supply or can be recharged to the ground through pits to raise the water table. In the semiarid Southwest, this ground-coating application offers promise of a partial solution to local water shortages. One calculation, based on an annual precipitation of 15 inches and an asphalt-treated area 6 by 9 miles, shows an annual collection of more than 8 billion gallons of water—enough to meet the requirements of a city of 100,000.

To learn as much as possible what nature does to a stream—free of man's influence—the Survey increased its "benchmark" network in 1966 to 36 stations, each equipped with automatic instruments which record streamflow, water quality, sediment content, and related information. Knowing about stream behavior in undeveloped areas helps in evaluating man's manipulation of the Nation's water resources in other areas.

Following a recommendation by the Federal Water Resources Council in its Northeast drought report to President Johnson, the Geological Survey inventoried emergency water supplies in 12 drought-affected Northeast States from New Hampshire to West Virginia. Included were streams, reservoirs, and ground-water sources. Such findings assisted officials responsible for local, State, and Federal waterworks to determine how much emergency equipment and supplies, pumps, and chemicals were needed. While the drought on the east coast was the longest and most severe on record,

(Left) Mountain streams like this, in the upper reaches of a watershed, generally test out clean and pure. Farther down the pathway to the sea, farms and cities eventually break down a stream's capacity to purify itself.

there was no regional shortage of water. The critical shortage was one of facilities. The drought, which started in 1961, had diminished in intensity by mid-1966, but the Atlantic coast from eastern Massachusetts to Delaware was still sharply affected.

During 1966, the Survey conducted hydrobiologic investigations in Everglades National Park, Fla., to help understand the water system in and adjacent to the park, to identify specific water needs, and to assess the impact, if any, of hydrologic changes on the plant and animal life of the region. Interpretation of the hydrobiologic studies will be particularly important in a few years when ultimate control measures and schedules of fresh-water releases into the park are to be determined.

Long-term studies of ground-water sources made in cooperation with State agencies frequently pay off with unexpected immediate benefits. In 1966, the discovery of a large underground channel of water-bearing rocks at Salisbury, Md., and the identification of a ground-water source expected to provide 30 million gallons per day from the glacial Passaic Lake area in northern New Jersey fell into this category. Another bonus was a development of a fresh-water well below salty Lake Pontchartrain in Louisiana. The 2,000-foot well resulted from a cooperative investigation with the city of New Orleans to define the fresh-water sources beneath the lake. This well supplied an area east of New Orleans with emergency drinking and sanitary water for many days in the wake of a damaging hurricane.

Electrical models that simulate ground-water and streamflow conditions and predict what will happen to ground-water levels and river stages over long periods of time when water is pumped from the ground are proving useful tools in planning water development. In the past year, models were used to provide the State of Ohio with predicted effects of new wells near the Great Miami River and to advise irrigators in the Big Blue River basin in Nebraska as to the influence that pumping of wells might have on flow of the Big Blue River. Similar models are being designed for parts of Long Island, N.Y., for the Potomac and Delaware basins, for areas in Georgia and Florida, and for the high plains of Texas.

Cooperating with the Commonwealth of Pennsylvania, Interior scientists hope to determine the most effective and least costly methods of preventing and controlling water pollution by acid mine waters. One site selected for study is the anthracite area of the Black Creek basin at Mocanaqua, Pa. Acid mine drainage occurs in areas where coal and mining wastes have been left exposed. This exposure triggers a chemical reaction forming sulfuric acid; rainfall, plus runoff, then carry this acid into streams. A possible solution in the Mocanaqua area is the reestablishment of natural drainage by diverting water away from spoil banks, strip pits, underground workings, and fractured zones to prevent pickup and movement of acid.

Sea-water intrusion in coastal streams and in subsurface water-bearing materials commonly escapes immediate notice and the encroachment continues quietly. However, many coastal areas in Florida now have salinity-control structures to hold sea water out, prevent excessive drainage of fresh water, and hold fresh-water levels high near the coast. Interior's Geological Survey cooperates with the Florida Geological Survey and with county governments in a continuing inventory of water level and salinity at observation wells and at sampling points on canals to monitor the movement of salt in the aquifer and canals; in a test drilling program to determine the extent of intrusion in the aquifer; in designing electrical analog models to determine the effects of proposed changes in a canal system and increase in pumpage; and in hydrologic studies of water level requirements necessary to control salinity in canals and the fresh-water flow required in canals to stop salt-water intrusion.

The mission of the Survey's Geologic Division is to acquire knowledge that will aid in discovery and development of minerals and fuels as a base for economic growth, permit the safe and efficient use of land for residential and all other construction projects, and advance the principles, tools, and methods of geologic science and technology.

The prime means for advancing all these objectives is study of the distribution, structure, chemical and physical properties, and history of the rocks and minerals on and beneath the surface of the United States and of other areas of concern to the United States.

The Wilderness Act of 1964 and its accompanying *Conference Report* recognize that the recreational and aesthetic values of wilderness lands are exhaustible natural resources that must be preserved for future generations. The Geological Survey, in cooperation with the Department's Bureau of Mines, has been assigned the job of evaluating the mineral potential of lands within or considered for inclusion in the Wilderness System.

Geological Survey research in economic geology in fiscal 1966 led to discoveries of new deposits from which major mineral production can be anticipated and identified areas where further exploration holds attractive possibilities for mineral occurrence.

Extensive deposits of K-feldspar were found in feldspathized volcanic tuffs near Barstow, Calif.

Studies of the chemistry of phosphate rock revealed that some deposits now being mined for phosphate for fertilizer and chemical uses also contain rare earth elements that might be recovered as coproducts to help meet the rising demand created by the electronics industry.

Near Battle Mountain, Nev., mineralized areas identified by the Geological Survey as favorable targets for exploration are now being developed by private industry as sources of copper, silver, and gold.

The area of known mineralization in the Knox Dolomite, chief ore-bearing rock unit in the east Tennessee zinc district, has been extended greatly by the discovery in it of sphalerite in Bibb County, Ala., and by identification of unusual amounts of zinc from oil sludge from this formation near London, Ky.

Recognition by the Survey of abundant algal reefs and petroliferous crystalline dolomite in Ordovician rocks in Tennessee has led to the leasing of more than 150,000 acres in Union and Claiborne Counties for oil exploration.

The Geological Survey has begun an intensified program to increase geologic knowledge and domestic resources of certain metals that are in short supply. They are classed

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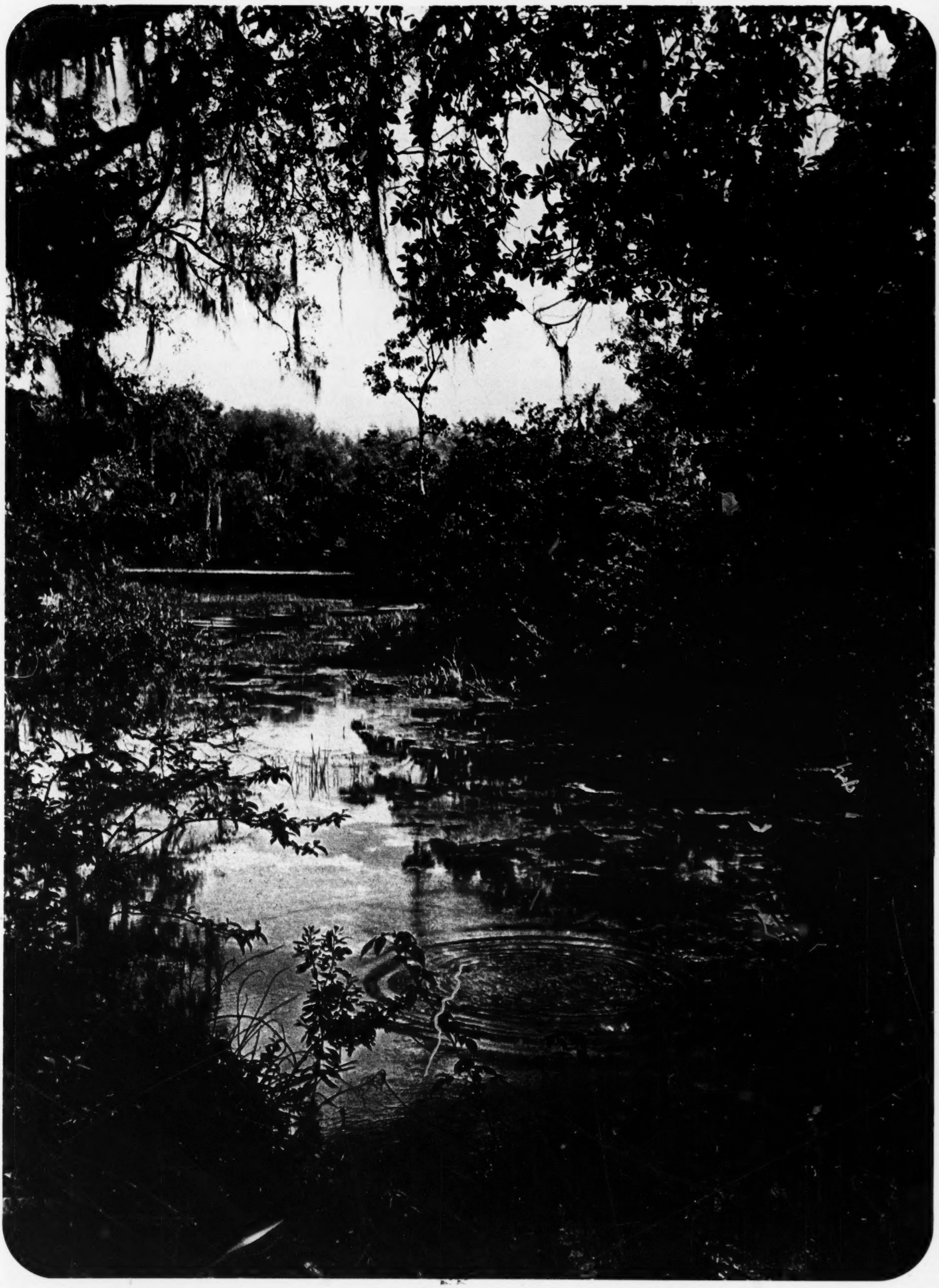
(Right) This unspoiled portion of Florida's Oklawaha River will soon be flooded out of existence by the Cross Florida Barge Canal dams.

Jim Jernigan — Audubon Magazine



as the "heavy metals" and include gold, silver, platinum, palladium, osmium, mercury, tin, bismuth, antimony, and tantalum. Consumption of these metals considerably exceeds domestic production, and known resources are small compared to rates of consumption. Many of these metals are produced primarily as byproducts, and hence are only recoverable at rates determined by the mining of other metals, such as lead, zinc, copper, and molybdenum.

Geologic field investigations will be supplemented by geochemical and geophysical field surveys, by laboratory studies of the chemical processes forming ore deposits, and by drilling or augering for necessary geologic information. Part of the effort will be conducted offshore to locate environments in which economic placer deposits may occur.

Recent developments in emission and absorption spectroscopy and in wet chemical techniques make possible the determination of gold, silver, and platinum in minute amounts with much greater speed than by conventional assays. A silver detector, based on the principle of neutron activation analysis, has been successfully field-tested. Modifications are underway to apply this principle to detecting trace amounts of other metals. These techniques are being developed to assist geochemical exploration in defining new targets.

Establishment of a National Center for Earthquake Research in the Geological Survey was announced in October 1965. The Center is at Menlo Park, Calif., and will be a focal point for work on earthquake prediction. American and foreign scientists will work with Geological Survey colleagues in the many scientific disciplines that are part of the effort. The proposed research includes geologic and geophysical studies of active fault zones, sophisticated instrumentation of seismic zones, rock mechanics studies to discover the physical processes that create earthquakes, and efforts in engineering geology to determine ground conditions responsible for hazards from shocks. Projects underway focus on the fault systems of Alaska, California, and elsewhere on the west coast, especially on the great crustal break of the San Andreas fault zone, along which many major earthquakes have occurred, including the disastrous 1906 shock at San Francisco.

On behalf of the National Aeronautics and Space Administration, the Geological Survey is studying geologic problems which must be solved before men can land on and explore the surface of the moon. Activities include mapping the side of the moon that faces the earth, interpreting photographs of the lunar surface obtained by Ranger and Surveyor spacecraft, studying fragments of matter called tektites found on the earth that may be of lunar origin, and training astronauts to conduct geologic and geophysical investigations. Under a related program, remote-sensing devices installed in high-flying aircraft and in earth-orbiting spacecraft are being developed and tested by Survey scientists to provide pertinent information in the form of black-and-white and color pictures, radar, infrared, and microwave imagery, and quantitative measurements of radioactivity, magnetism, and gravity on a global scale. Using this new technology, scientists can look back at the earth and study geology, hydrology, geography, oceanography, agriculture, and forestry with a new perspective.

For more than 25 years the Geological Survey has helped developing nations appraise their natural resources and train their earth scientists. These efforts have gained momentum in recent years under the auspices of the Agency for International Development. In the past year, for example, the Survey had 135 specialists in 28 countries and also provided or helped arrange training in the United States for 103 geologists and engineers from other nations. Oversea projects, all based on requests from foreign governments, have included many types of investigations. Following are some examples:

On the day after eruption of Taal Volcano in the Philippines, President Johnson dispatched a Survey volcanologist to collaborate with the Philippine Commission on Volcanology in studying the eruption and in assessing dangers from future activity.

The rapidly increasing world demand for phosphate took Survey specialists to many countries in search of this key ingredient of fertilizer. New deposits identified or appraised in India, Pakistan, Thailand, and Saudi Arabia could contribute to agricultural productivity by rebuilding soils depleted by centuries of cultivation.

A study of the Red Sea floor in cooperation with Woods Hole Oceanographic Institution resulted in the discovery of deep depressions containing sediments unusually rich in iron, zinc, copper, and manganese.

The major function of the Topographic Division is to prepare and maintain maps of the National Topographic Map Series covering the United States and other areas under its sovereignty. The individual series at various scales are needed to inventory, develop, and manage the natural resources of the Nation. They are also essential for land utilization and numerous other programs.

To aid in unlocking the secrets and resources of the "frozen continent," the Geological Survey has conducted surveys, obtained aerial photographs for mapping, and prepared topographic maps of Antarctica. Carried out as part of the U.S. Antarctic Research program of the National Science Foundation, these activities support many scientific studies, including geology, glaciology, seismology, geodesy, atmospheric characteristics, biology, and meteorology.

A valuable tool for planning land and resource uses, development, and conservation will be *The National Atlas of the United States of America*, being prepared by the Survey's Topographic Division. Intended as a reference and research tool for government agencies, educational institutions, and business and industrial firms, it will contain hundreds of thematic maps of the country dealing with such physical features as landforms, geology, soils, vegetation, and climate as well as economic, social, cultural, political, and historical information.

The Geological Survey also is assisting foreign countries by giving advice on surveying and mapping projects, by training foreign personnel, and by helping in the preparation of certain worldwide map series.

Over the past several years, the Geological Survey has developed the ABC system—a technique and equipment for providing ground control for mapping which uses a combination of measurements taken on the ground and from a hovering helicopter.. This involves electronic distance measurements and horizontal and vertical angle measurements from two or more strategically located control stations to a helicopter as it hovers vertically over each desired new control point. Accurate hovering is facilitated by a newly developed "hover-

(Right) A far-out look at the earth, like this view of Baja California, Mexico, the Gulf of California (at left) and Pacific Ocean (at right) taken from Gemini V, provides earth scientists with a new perspective.

(Above) The most detailed physiographic map of the United States ever prepared to date will appear in Survey's new National Atlas.

sight." A special plumbline cable and drum are used to measure the hovering height.

The Geological Survey has developed methods for preparing and printing a new-type map in which the conventional lines and symbols are replaced by photographic imagery. For many types of terrain, these maps can provide a wealth of information not available on a conventional map. Individual trees, bushes, clumps of grass, boulders, ponds, and similar features, too small to plot on a conventional map, are readily discernible on these maps. When the photoimagery is printed on a regular map format and is overprinted with names and classification information, and with selected line symbols such as contours, the maps are called photomaps.

The responsibilities of the Survey's Conservation Division relate to the wise use, proper management, and economical development of the mineral and water resources of Federal lands. A significant fraction of the Nation's resources of oil and gas, coal, potash, sodium minerals, and phosphate are in public lands and subject to the provisions of the Mineral Leasing Act. These basic minerals, essential to the industrial and agricultural growth and general economic well-being of the Nation, are produced from public lands under leases supervised by engineers of the Conservation Division.

Supervision assures that these leasable minerals are developed to optimum levels of production with proper conservation of remaining resources for future use. The Division is also concerned with assuring a fair royalty return to the Government for minerals produced under Federal lease, and is responsible for the accounting and collection of royalties from mineral production.

The Conservation Division is also responsible for continually updating its classification of the public lands as mineral or nonmineral, which prevents alienation of mineral resources in lands subject to disposal. Classification also identifies many deposits of leasable minerals of such a quality and commercial value that they are subject to competitive rather than noncompetitive leasing. Advisory service relating to mineral lands is provided to many executive agencies or departments, and to Members of the Congress.

Attention is being placed on more skillful management of water resources. To meet growing demands, all available methods must be used to develop more water. Surface storage in reservoirs is one method. Estimates indicate that storage requirements by 1980 will be nearly double of those of 1965. The number of good reservoir sites is limited and should be preserved from other uses. The public lands will contribute significantly to sites for future reservoirs. The Geological Survey, through its reservoir site classification program, identifies such sites on public lands and initiates their preservation under laws designed to prevent land uses which will preclude future efficient water development.

© National Geographic Society

Fertile green patches bloom in an Arizona valley near Yuma, along the purposeful meanderings of an irrigation canal.

Bureau of Reclamation

The primary purpose of the Bureau of Reclamation program always has been conservation of natural resources, especially that most precious resource of all—water. Through the years, as conservation progressed from a policy of simple preservation, through multiple-use, to today's ecological approach, the Bureau of Reclamation has been a leading participant.

Originally designated the Reclamation Service, the agency was created six decades ago to irrigate the dry lands of the West and make them capable of settlement. By building those arid acres into a viable economy, Reclamation served to benefit not only that area, but the entire Nation.

As the water needs of America escalated and changed, the role of the Bureau expanded and evolved to meet them. Bureau functions multiplied to include, besides irrigation, hydropower generation, flood control, municipal and industrial water supply, water quality improvement, outdoor recreation, and fish and wildlife enhancement.

Not only its functions but its whole method of operating changed as the ratio between human needs and natural resource supply narrowed. More people require more food, more electricity, more water to drink and use in their homes, more water to work in their industries, and more recreation.

In its infancy the Bureau of Reclamation was concerned only with water that flowed in streams and rivers. Gradually broadening that scope, it is now vitally concerned with all sources of water—that in our natural waterways, ground water, moisture carried in the atmosphere, and even the salty sea. In its early days it usually built only a single-purpose project at one site. Soon it expanded its operations to include development of the entire length of the stream, then of the whole river basin. Now it is engaged in interbasin development as the most efficient and most economical method of filling the Nation's urgent need for water.

The regional approach to water resources is embodied in the potential Colorado River Basin project, an outgrowth of efforts by Secretary Udall, the Bureau of Reclamation, and others to solve the serious water-supply problems of a large section of the arid West. The broad-scope CRBP would ultimately develop needed additional water, not only for the parched Lower Colorado River area, but also for the upper basin States. All Reclamation benefits would be included in the project—irrigation, municipal and industrial supply, flood control, hydroelectric generation, water quality regulation, recreation, and fish and wildlife betterment.

The comprehensive plan provides for construction of dams, powerplants, and distribution systems to meet the most immediate needs of the basin area. It also provides for a basin fund to help finance facilities that will be required to meet future needs. And, finally, it would start studies looking toward the best means for augmenting the water supply of much of the West—by importation from outside sources, by desalination plants, or by other means.

Evolving from the Bureau of Reclamation's Pacific Southwest Water Plan, the Colorado River Basin plan is the joint creation of the States, local entities of the area, and the Federal Government. Legislation to authorize the project was under consideration at year's end.

The changing emphasis of the Reclamation program is illustrated by its allocation of expenditures. During the first 10 years of the agency's operations, 97.3 percent of its activities related to irrigation, 1 percent to power, and 1.7 percent to all other purposes. Now, a half century later, irrigation accounts for approximately 33 percent of the program. About 66 percent of the Bureau's activities are geared to hydropower generation, flood control and navigation, municipal and industrial water supply, recreation, fish and wildlife enhancement, river regulation, and water quality control.

During fiscal 1966, the Bureau established the highest record of achievement in its 64-year history. Moreover, this was attained with 171 fewer employees than in 1965.

The 12-month period saw completion of 11 dams with reservoirs having a combined impoundment capacity of 2.8 million acre-feet of water. (An acre-foot equals approximately 326,000 gallons.) A total of 457,200 kilowatts of electric power generating capacity was installed, as were 900 miles of high-voltage transmission lines to carry power to the homes and industries of the West. Construction of 733 miles of canals, pipelines, laterals, and drains also was completed.

These additions to the Reclamation plant brought the number of Reclamation dams to 248, capable of impounding 129.5 million acre-feet of water, enough to put New York State under nearly 4 feet of water.

The Bureau now operates hydroelectric powerplants with an installed capacity of 6.7 million kilowatts; transmits the output, plus some from non-Bureau plants, over 14,500 miles of high-voltage lines constructed by the agency; and markets energy from plants with a combined capacity of 8.7 million kilowatts.

At the end of the year there were under construction 17 dams having a total reservoir capacity of 5 million acre-feet, 4 powerplants and 2 pump generating plants with a combined capacity of 917,200 kilowatts, and 623 miles of high-voltage transmission lines.

Reclamation construction in 1966 created jobs for between 15,000 and 20,000 men at project sites over the West, while the manufacture and delivery of machinery, supplies, and equipment provided employment for 25,000 to 30,000 other workers throughout the Nation.

Much of the construction was in California, where a pyramiding population and expanding economy continued to increase the use of water. A steadily sinking ground-water table in much of the Central Valley illustrates the effects of man's destructive assault on his environment during past decades. It also highlights one of the facets of today's conservation—to restore what has been destroyed, as well as to preserve and enhance the unexploited resource reserve.

For example, ground-water overdraft by pumping from the Arvin-Edison Water Storage District in the San Joaquin Valley has been averaging 200,000 acre-feet (nearly 65 billion gallons) a year. A distribution system, financed by the Bureau of Reclamation under the Distribution Systems Loan Act, is being constructed to convey surface water from the Bureau's Friant-Kern Canal and will make possible the delivery of nearly enough water to halt the overdraft. Much of this water will be allowed to percolate into the ground to replenish the ground-water aquifer, and some will be used for surface irrigation.

Congress authorized the Auburn-Folsom South Unit of the Central Valley project in the fall of 1965. With a benefit-to-cost ratio of nearly 4-to-1, the unit is termed a "model of multiple-purpose development." Its operation will raise the ground-water level in the valley, and will supply water for irrigating 413,000 acres and for municipal and industrial needs as well as for hydropower production. It also will create, behind Auburn Dam, a large new lake which is sure to become a popular outdoor playground.

A 1966 "new start" on the Central Valley project was beginning of construction of Contra Loma Dam, adjacent to Contra Costa Canal. The dam will make more reliable the system's supply of municipal and industrial water through the canal.

During 1966, the first 16-mile section of the San Luis Canal in California was completed and work began on the final reach of what will be one of the largest manmade rivers in America, capable of carrying about 100,000 gallons of water per second. A Federal-State undertaking, the concrete-lined canal will convey water southward 103 miles from the Bureau's San Luis Dam near Los Banos to irrigate half a million acres of Reclamation-served land. Also the State will use it to carry

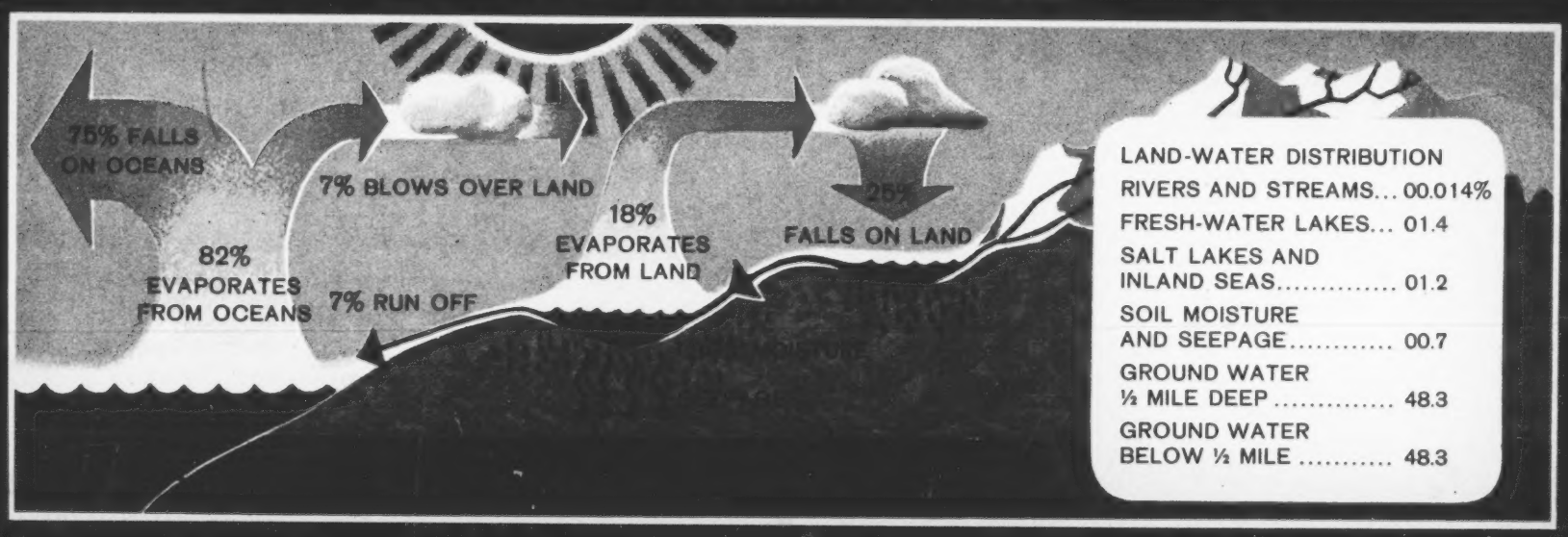
about 500,000 acres. The entire system, scheduled for completion in 1970, will have over 1,000 miles of irrigation pipelines. Its costs are to be repaid by the water users under a $157,048,000 contract with the Westlands Water District—the largest such contract in Reclamation history. Water for this distribution system will be imported from northern California via facilities of the Central Valley project, with structures of the San Luis Unit providing the final link.

Within the upper Colorado River Basin project, work continued in developing the river which is the lifeblood of a 110,500-square-mile area embracing parts of Colorado, Utah, Wyoming, New Mexico, and Arizona.

On the Curecanti Unit in southeastern Colorado, Blue Mesa Dam, a 340-foot-high earthfill stucture plugging the Gunnison River, was completed and construction of the 60,000 kilowatt powerplant in the toe of the dam entered its final phase. By the end of the year, 465-foot-high Morrow Point Dam 12 miles downstream and its 120,000-kilowatt powerplant—the Bureau's first to be placed underground—were about half finished.

A significant event in the project during the year was startup of the power dispatching center at Montrose, Colo.

THE WATER CYCLE


75% FALLS ON OCEANS
7% BLOWS OVER LAND
18% EVAPORATES FROM LAND
25% FALLS ON LAND
82% EVAPORATES FROM OCEANS
7% RUN OFF
LAND-WATER DISTRIBUTION
RIVERS AND STREAMS... 00.014%
FRESH-WATER LAKES... 01.4
SALT LAKES AND INLAND SEAS..... 01.2
SOIL MOISTURE AND SEEPAGE..... 00.7
GROUND WATER ½ MILE DEEP 48.3
GROUND WATER BELOW ½ MILE 48.3

over 1 million acre-feet of water annually for irrigation and municipal and industrial use, transporting the water by a State-owned canal still farther south across the Tehachapi Mountains to the southern California coastal area.

The San Luis Dam, to be the Bureau's largest earthfill dam when completed in 1967, will impound more than 2 million acre-feet of water.

A major event on the San Luis Unit during 1966 was the start on the first 62 miles of pipelines for the Westlands Water-District distribution system that eventually will irrigate

This is the nerve center for the project, including six dams and storage reservoirs, 2,500 miles of high-voltage transmission lines, and 2 million kilowatts of electric power, some of which is owned by public agencies outside the Bureau. The "brain" of the dispatching center is a high-speed electronic computer which automatically controls water releases, power production, and power dispatching functions for the entire storage project's transmission grid and tie lines.

Another important completion during the year was a high-voltage transmission line to carry electricity from Glen Canyon

powerplant to serve the fast-growing metropolitan area of Phoenix and southern Arizona and to interconnect with other utilities, public and private.

Essentially complete during 1966 was a transmission line crossing the Continental Divide near Monarch Pass at 11,580 feet above sea level.

As electricity flows over the mountains, water frequently must be forced to flow under them. Because of the mountainous terrain of the Colorado River Basin, much of the Reclamation work there requires tunneling to divert water from one watershed to another. Ever since 1905, when the Bureau started a tunnel to transport Gunnison River water through a rocky ridge to the Uncompahgre Valley in Colorado, Reclamation workers have been toiling—first with picks and shovels, then with dynamite, and now with great rock-boring machines—to burrow through the mountains.

In the spring of 1966 one of these monster machines "holed through" the 2-mile Tunnel No. 1 on the Navajo Indian Irrigation project in northern New Mexico, a participating project of the CRSP being built by Reclamation for the Bureau of Indian Affairs. The "mole," largest drilling device ever used on a Reclamation project, ate its way through the sandstone at the rate of 61 feet a day.

Similar, though smaller, machines were being used at year's end to drill two tunnels on the San Juan-Chama project in New Mexico, another participating project of the CRSP. The project is a multiple-purpose transmountain diversion to convey water through the Continental Divide from tributaries of the San Juan River into the Rio Grande Basin for water-short areas of New Mexico.

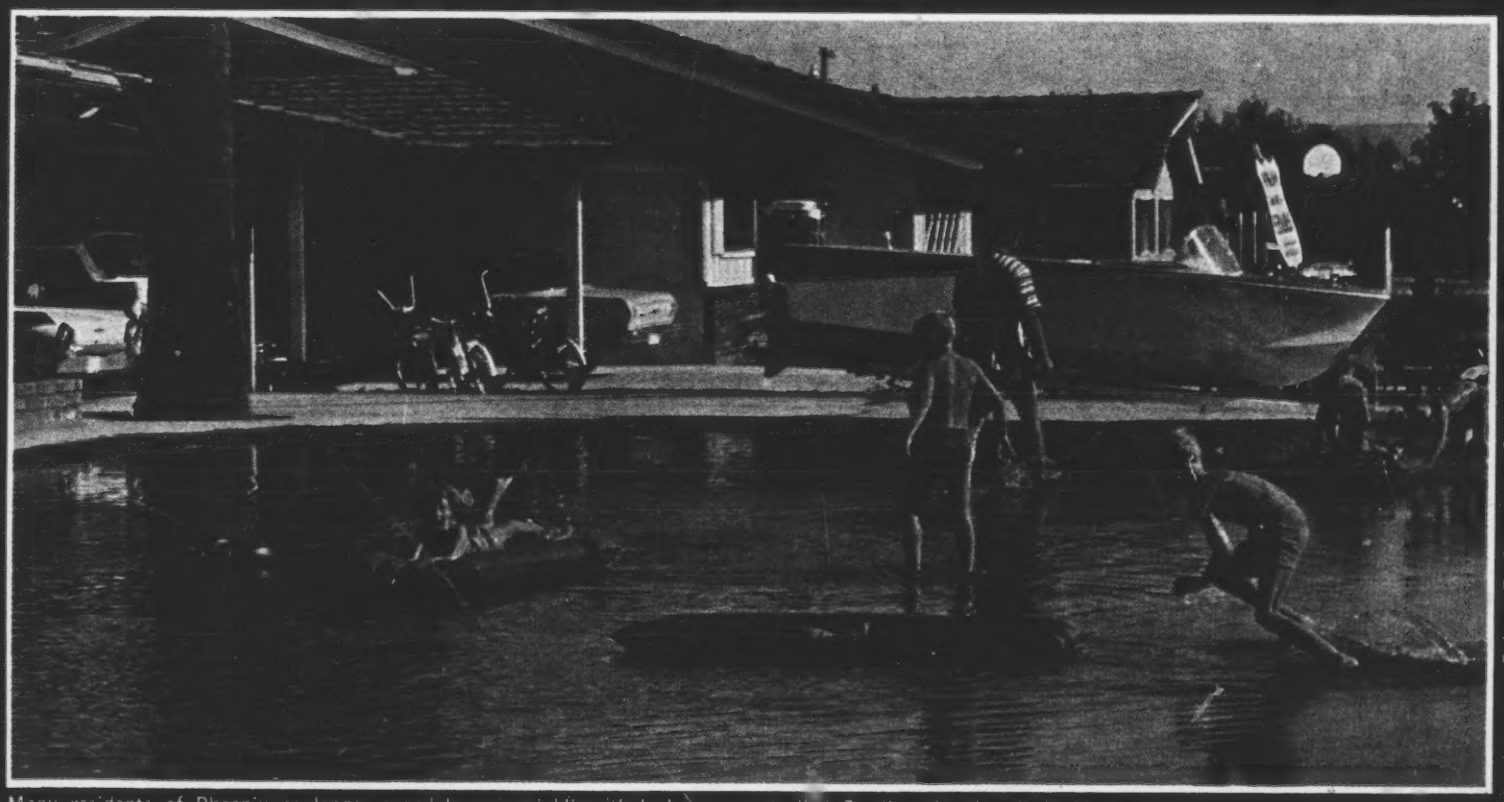
Work also advanced on 11 miles of tunnels and on Ruedi and Sugarloaf Dams on the Fryingpan-Arkansas project in Colorado, one of Reclamation's largest transmountain diversion developments.

A significant event in Reclamation's development of the 10-State Missouri River Basin project occurred in 1966, when President Johnson signed a bill authorizing construction of the initial stage of the Garrison Diversion Unit. Water from the Garrison Reservoir, behind the U.S. Army Corps of Engineers' Garrison Dam on the mainstem of the Missouri River in central North Dakota, will provide irrigation for 250,000 acres in that State. In addition to stabilizing and diversifying the region's agriculture, the initial stage of the unit will supply municipal and industrial water for 14 towns and cities and 4 industrial areas, enhance fish and wildlife resources at 36 major areas and numerous smaller areas, and develop recreation opportunities at 9 large water impoundments.

Reclamation projects are increasingly concerned with facilities to meet the water needs created by burgeoning urban concentrations in the West. A mere decade ago 25 projects delivered a total of 53.9 billion gallons annually to communities for these uses. Today that figure has increased tenfold. In calendar year 1965, a total of 44 projects provided 546.1 billion gallons of water to meet the domestic and industrial needs of 12.4 million people. This is enough water to fill the requirements of 11 cities the size of Denver.

Five new projects began providing municipal and industrial water during 1965, providing 4.2 billion gallons for 344,000 people, more than reside in the State of Nevada.

The largest municipal and industrial water supply development in Reclamation history was nearing completion at year's end. Starting in 1967, the Canadian River project in Texas will supply 11 cities in the panhandle region of that



Many residents of Phoenix no longer spend hours sprinkling their lawns; controlled floodings by the Salt River project do the job. Water flowing through open ditches and pipes, is turned on and off at scheduled intervals, good for the grass and fun for the kids.

State. The project includes Sanford Dam on the Canadian River and a 322-mile pipeline distribution system.

In more than half the world hunger is an ever-present condition of life, famine a frequent threat. The United States still has ample food. However, as the world population, including ours, increases at an alarming rate, we must build our food-production potential. The Bureau of Reclamation, through its irrigation program, is helping increase our yield of high-vitamin, quality foods.

The 1965 crop season set a new high in total production on Reclamation projects, with gross value of about $1.6 billion, $100 million more than in 1964.

Eight million acres received irrigation water from project facilities during the year, an increase of about 489,000 acres over 1964. The largest portion of the increase in irrigable acreage in 1965 was in land receiving supplemental water. This reflects the continued emphasis of the Bureau of Reclamation to improve and stabilize irrigation-based economies suffering from otherwise insufficient water supplies.

Hydropower generation is an outstanding example of natural resource conservation, being completely nonconsumptive. None of the falling water is expended—it simply performs a service by producing kilowatts on its way to fulfill other functions.

In view of the Nation's concern for environmental beauty and cleanliness, it is noteworthy that hydropower generation does not pollute either the water utilized nor the surrounding air. The possibility of both air and water pollution is inherent in thermal generation.

When the energy of falling water is transformed into kilowatts, it frees nonrenewable resources—such as coal, oil, and gas—for other uses in our economy. It also increases the efficiency of different modes of electric generation by providing "peaking power" to supplement the baseload power produced at thermal plants. Fuel-powered generators usually require a costly building-up of pressure to increase their output; in a hydroplant the mere opening of a valve to let more water into the turbines suffices.

With today's improved transmission systems and interconnections it becomes providentially practical to use hydropower for peaking purposes—during those hours when demands on a system rise rapidly, such as the early evening—and to use fuel for the base load, which is more or less constant. Integration of hydroelectric peaking power with thermal systems will result in dependable lower cost power for thousands of customers. Such a power partnership has a bright future, especially in the fast-growing West, where demands for electric power are growing hourly.

A major addition to the power supply of the West will result from construction by the Bureau of Reclamation of a third powerplant at the Grand Coulee Dam on the Columbia River in Washington State. Authorized by Congress in June 1966, this plant will increase the capacity at Grand Coulee by 3.6 million kilowatts, to a total of 5.6 million, greater than any plant in existence today. It will take full advantage of the improved streamflow that will result from construction of upriver dams to be built under the treaty with Canada for joint development of the Columbia River. It will also make efficient use of the Pacific Northwest-Southwest Intertie to provide kilowatts to the power-hungry Southwest. Construction of the third powerplant at Coulee, with its 12 new generators, is expected to start in 1967. The first additional generators are scheduled for completion in 1973, with all 12 units "on the line" by 1982.

When President Johnson signed the third powerplant authorization bill, he pointed out the benefits Coulee Dam and the Columbia Basin project, of which it is part, have already brought to the Northwest and the Nation. Thousands of homes and farms have been modernized by electricity, new towns established, and tens of thousands of new jobs created. An even greater future is foreseen with the additional electricity the third powerplant will supply.

Construction of the Pacific Northwest-Southwest Intertie, which began during fiscal 1966, represents one of the most important power developments in the United States in many years. Tieing together public and private systems from Seattle to Los Angeles and Phoenix, it will deliver electricity to users in 11 Western States and will make possible power exchanges advantageous to both Northwest and Southwest. Engineers estimate that this project will prevent the waste of $20 million in electric power annually, as well as permit utilities in both Northwest and Southwest to meet peakloads with considerably less plant investment than otherwise would be required.

As its part in the cooperative effort, the Bureau of Reclamation is building two high-voltage lines, one from Hoover Dam to Phoenix, the other in northern California. It also will build a 750,000-volt direct-current line from the Oregon-California border to Hoover Dam.

In the past, distance has dictated the range of power utilization, and has often decreed power feast and famine side by side. By employing direct-current transmission on a major scale, the Pacific Northwest-Southwest Intertie has now broken the distance barrier in the United States and has made economically feasible the transport of large amounts of energy over long stretches.

A fundamental feature of the Reclamation program is that, to a large extent, the direct beneficiaries of a project pay for it. Nearly 90 percent of the cost of constructing multimillion dollar developments to conserve water for the use and enjoyment of all the people is repaid to the U.S. Treasury in cash. Federal investment for power and municipal and industrial water facilities is repaid, with interest, by electricity and water users, and that for irrigation features is repaid in full, but without interest. About half the cost of irrigation elements is borne by the water users and the remainder is repaid through the sale of surplus power and from other revenues after costs allocated to power and additional reimbursable purposes have been met.

Adequate outdoor recreation amid beautiful natural surroundings is an important new trend in national resource conservation. Reclamation projects, though originally developed for more prosaic purposes, provide ever-increasing outdoor recreation for millions. The inviting manmade lakes behind Bureau of Reclamation dams throughout the West provide physical and spiritual refreshment for those who visit them.

In a recent year, more than 36.5 million visitor-days of use were recorded at the 216 recreation areas on Reclamation projects. About 14 million sightseers viewed the varied, often spectacular scenery which is a backdrop for many projects, and enjoyed the manmade features. These include not only

Spraying reservoirs with a chemical film helps prevent loss of precious water through evaporation.

the deep blue lakes behind the dams, but the impressive dams themselves, the great powerplants, the fish hatcheries, and related structures.

Next to sightseeing, the most favored activity at Reclamation's recreation areas is fishing. Six and a half million persons fish every year at lovely lakes and the sparkling streams of the projects. Last year, 4.5 million boaters and skiers skimmed over the 1.4 million acres of water surface, and 3.8 million visitors picnicked in the great outdoor playgrounds, many using tables, fireplaces, and other facilities furnished for their convenience. The exciting experience of camping out was enjoyed by 3.5 million project visitors, while reservoirs furnished exhilarating sport for 2.2 million swimmers.

The pyramiding popularity of two fairly new lakes on the Colorado River—Lake Powell behind Glen Canyon Dam at the Utah-Arizona border and Flaming Gorge Lake impounded by the dam of the same name on the tributary Green River at the Utah-Wyoming border—continued last year to lure hundreds of thousands of visitors. Boaters on Lake Powell, venturing up small side canyons, saw and preserved on camera film the steep, breathtaking, colorful rock walls heretofore seen by only a handful of hardy hikers. They also fished and swam and skied. The scene was duplicated at fabulous Flaming Gorge, where thousands witnessed the grandeur of what was once an isolated outlaw "hideout" deep in virtually inaccessible wilderness. The Flaming Gorge Dam and powerplant were open to public tours for the first time on Memorial Day, 1966, when large groups of "sidewalk engineers" inspected the two impressive installations.

Every year sees an increase in the number of persons enjoying tours of project facilities. More than half a million of the 4.2 million visitors to Lake Mead National Recreation Area last year took the guided tour of Hoover Dam, a long-time favorite with sightseers which, during the past season, welcomed its 11 millionth visitor. And 325,000 inspected the wonders of Grand Coulee Dam via a self-guided tour.

During 1965, 7 new reservoirs, opened to the public for recreation on recently constructed projects, attracted a total of nearly 855,000 outdoors buffs.

Yellowtail Reservoir, which began filling in 1965, when Yellowtail Dam on the Bighorn River in Montana, was "topped out," is luring nature lovers. Rich in scenery and in geological, archeological, and historical significance, as well as in outdoor sports potential, the area in 1966 was designated by law as the Bighorn Canyon National Recreation Area. It drew 37,000 visitors in 1965, and visitors are expected to exceed half a million within 5 years.

During the first 6 months that Lake Meredith, behind newly completed Sandford Dam on the Canadian River in Texas, was open to the public nearly 277,000 outdoorsmen participated in its water-oriented sports opportunities, even though access roads and recreation facilities were not completed. An annual use of 1.5 million visitor-days is considered probable in the near future.

More than 306,000 visitors from the populous surrounding area enjoyed the recreation provided by Cheney Reservoir on the North Fork of the Ninnescah River in Kansas. This lake is part of the newly completed Wichita Reclamation Project, which, like the Canadian River project, is primarily a municipal and industrial water supply development.

Other Bureau reservoirs opened for the first time in 1965 to public recreation were Lake Thunderbird on the Norman

project in Oklahoma, Fontanelle on the Seedskadee project in Wyoming, Willard on the Weber Basin project in Utah, and Norton on the Missouri River Basin project in Kansas.

Recreation and fish and wildlife enhancement have been "spin off" benefits of Reclamation construction ever since the first dam began to impound water over 60 years ago. However, there was no general legislative recognition of these benefits until recent years.

Although the Bureau has for some time included recreation needs in planning its projects, only when recreation facilities were specifically provided for in congressional authorization of a project has the agency been able actually to build them. The Federal Water Project Recreation Act of 1965 granted the Bureau limited authority to develop recreation opportunities on existing projects. More importantly, it established uniform policies for recreation and fish and wildlife aspects of Federal water project development and provided for cost-sharing by local groups.

The Bureau of Reclamation usually transfers management of recreation on its projects to other Federal agencies or to State and local entities. Recreation development in cooperation with these groups has proved most effective in making outdoor recreation pleasures available to the public.

With natural water areas having virtually reached the limit of their fishing capacity, manmade waterways now constitute the major present prospect for additional angling. The Bureau cooperates with Federal and State fish and wildlife authorities to stock its impounded waters.

Not only are the large reservoirs, with widespread fish-planting programs, providing sport for fishermen, but canals are now being developed as fisheries. Several sections of the Delta-Mendota Canal on the Central Valley project in California were recently opened to fishing, and a new method of fish propagation is being built into the Tehama-Colusa Canal on the same project. The first 3 miles of this canal below Red Bluff Diversion Dam on the Sacramento River have been designed as artificial spawning beds for fall chinook salmon, and fish eggs will be planted in the shallow, gravel-lined waterway. A small canal connecting this upper section of the canal with the river will give the fish a highway back to the river and on down to the sea. When they mature, the fish will return upstream to spawn in their birthplace, creating a completely new spawning area.

At the Whiskeytown-Shasta-Trinity National Recreation Area in California, established by Act of Congress in 1965, an event of the year was the recording of the six millionth visitor to Shasta Dam, a principal feature of the recreation complex set in the incomparably lovely forest lands south of Mount Shasta. Ten million visitors annually by 2000 are predicted for the extensive playground, which is within 1 day's drive of the large and expanding population concentrations of the San Francisco Bay area and of Sacramento, and is also accessible to thousands who reside in Los Angeles and in Oregon and Washington.

Five of the presently designated national recreation areas are at Reclamation reservoirs: Bighorn Canyon, Montana and Wyoming; Whiskeytown-Shasta-Trinity, California; Rocky Mountain, Colorado; Lake Mead, Arizona and California; and Coulee Dam, in Washington. Legislation was introduced in Congress last year to establish such areas at Glen Canyon and Flaming Gorge on the Colorado River Storage Project.

Under the nationwide natural beauty campaign, the Bureau of Reclamation conducts a program to improve the appearance of its structures and to design new facilities that will enhance or blend with the natural landscape.

After a project is built, the construction site will be returned as far as possible to its natural state; excavated areas will be graded and seeded where practicable and all unsightly debris removed. Buildings on projects are being designed and landscaped to harmonize with their surroundings; billboards are being phased out.

The overhead transmission line, an ogre to aesthetics, is being scrutinized critically be the Bureau, the objective being to find feasible ways to keep lines out of public view as much as possible, and to improve the appearance of towers. Underground installation of lines and other equipment is being studied.

Because cleanliness is basic to beauty, the national water pollution control program is closely allied to beautification. The Bureau of Reclamation is deeply involved in the effort to clean river basins and prevent further pollution of waterways.

Reclamation's attack on water pollution covers three fronts: Consideration of water quality objectives and pollution control measures in planning new projects; adoption of measures to enhance the quality of water on projects now operating; and expanding research to provide new knowledge and tools for increasing the effectiveness of future antipollution work.

Experts estimate that by 1985, water requirements of the United States (exclusive of water for hydropower generation) will be 145 trillion gallons, compared with 99 trillion gallons used in 1960. Throughout the world, constantly growing multitudes will be using many times the water they now require. But the amount of moisture on earth today is substantially the same as it has been for eons. There is no "new" water.

The Bureau of Reclamation, through research, is accelerating its quest for water sources—in the atmosphere, underground, in the sea. It seeks to develop new ways to harness the precious resource at each stage of its cycle; new ways to prevent its pollution; new ways to reuse every drop time after time; new ways to prevent water loss by curbing evaporation, seepage, and weed consumption.

A significant area of this research involves weather modification studies and experiments to discover ways to increase the water supply of the arid West. Bureau scientists seek to induce precipitation from clouds—to increase the runoff, which then could be stored in reservoirs for release during dry periods.

Because much of the water in the Western States comes from the melting of winter snowpack in the mountains, the Bureau's primary research during the year concentrated on precipitation induction (cloud seeding) of mountain cloud systems. Since summer thunderstorms are a major source of moisture for the Great Plains, the researchers also studied charcteristics of convective cloud (thunderstorm) systems.

One facet of weather modification research is development of instruments to transmit meteorological and hydrological information from remote or inaccessible sites to a central

point where the facts can be analyzed. In this study, aircraft equipped with highly intricate instruments obtained needed data from within the clouds.

Bureau engineers continued cooperative work with the Atomic Energy Commission and the Department's Office of Saline Water designing desalting plants which would use atomic energy to convert salt water to fresh. The team has completed 15 such plant designs in the 50-million-gallon-per-day range.

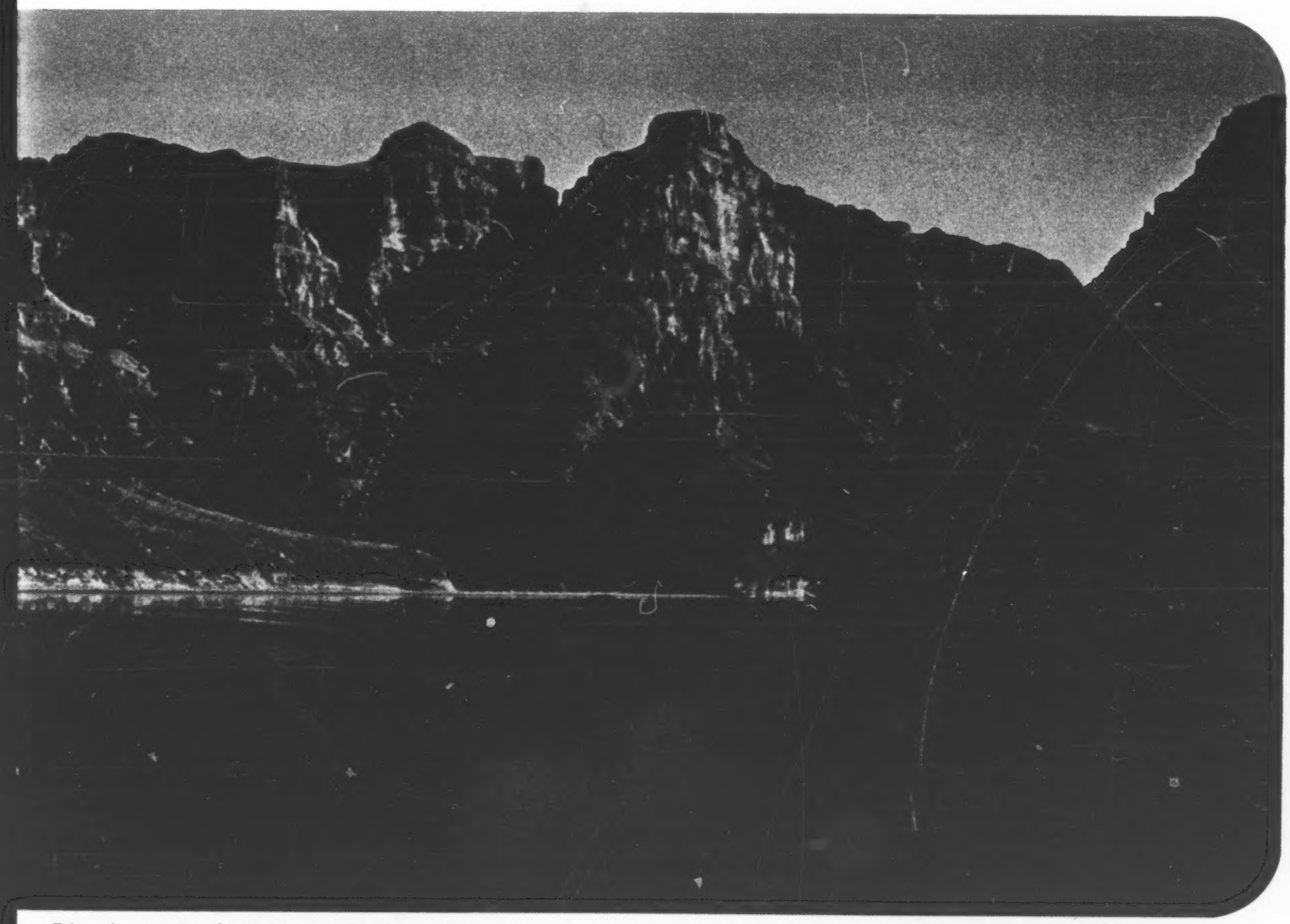
Because both hot brine and distilled water in saline conversion plants attack concrete, Bureau engineers escalated their laboratory studies to fight such deterioration.

While seeking to increase the usable water supply, the Bureau is redoubling its efforts to save water already available. Intensive research continued in fighting evaporation and seepage, two notorious water thieves. Perfection of instruments and techniques for measuring evaporation rates accurately was emphasized.

Noteworthy progress was in applying plastic and synthetic rubber materials in Bureau construction. Several years of research were climaxed in fiscal 1966 with permanent use of a plastic lining in a canal to prevent seepage. Similarly, research made possible the first construction application of butyl rubber sheeting for roofing and for waterproofing concrete structures. The Bureau's first installation of butyl rubber lining was made in three concrete irrigation regulating reservoirs. This inexpensive lining easily prevents water loss at construction joints.

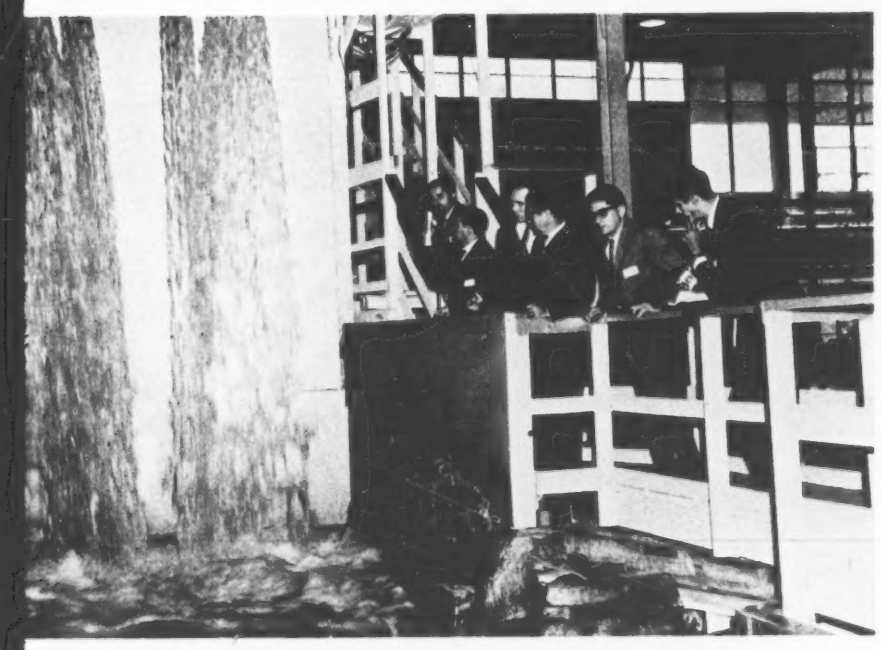
At year's end, work was essentially complete on a mobile radioisotope laboratory which will be used widely in the field. One study will seek to perfect radioisotopic tracer techniques for measuring flow by dispersing harmless amounts of isotopes in water and then tracing their movement. The information then can be translated into velocities. For large flows, this is superior to constructing costly measuring devices. Furthermore, it permits calculations at different locations.

When the laboratory is fully equipped, the Bureau will use it in cooperative studies with the Atomic Energy Commission on reservoir seepage and in testing flow through a powerplant. Other investigations will include studies of ground-water movement, reservoir currents, sediment, water quality, corrosion, and weed eradication. The new mobile



Take a large portion of very dry outstanding desert scenery. Simply add water, don't even stir.
The result—instant recreation, as shown here at Lake Mead, Nevada, above Hoover Dam.

Job Corpsmen from the Lewiston Conservation Center in California plant Ponderosa and sugar pine seedlings to re-cover an area that was burned over by a forest fire.



(Above) Brazilian Resources Planning Team members view a Morrow Point Dam spillway model at Reclamation's Denver lab. (Below) Weber Basin Conservation Center Job Corpsmen construct picnic shelters at Willard Reservoir in Utah.

unit will eliminate makeshift conditions and provide means for obtaining more reliable and complete field data.

An outstanding accomplishment in fiscal 1966 was a Reclamation engineer's development of a sensing device to reduce or eliminate service interruptions between interconnected power systems. The equipment will help assure future successful interconnections of the Nation's power systems, public and private.

In proposing an international "Water-for-Peace" program, President Johnson said:

"The earth's water belongs to all mankind. Together we must find ways to make certain that every nation has its share, and that there is enough for all."

Although the Bureau of Reclamation is concerned primarily with developing this Nation's resources, it also helps foreign countries fight want and hunger by developing their own resources.

Resource needs of the underdeveloped countries are virtually identical to America's. However, they generally are more immediate and intense. Such nations lack knowledge and training for creating and operating water-supply systems for agriculture, human and industrial consumption, and power generation.

In all these fields the Bureau gives assistance in two ways: It sends teams of technicians abroad to help plan projects and to train their native counterparts; it provides technical training and observation programs in the United States for representatives from those countries.

The Bureau's services are requested by the Agency for International Development, the United Nations and various other international organizations, public and private entities and foundations, and the foreign governments themselves. All costs are paid by the requesting agency or government.

During fiscal 1966 more than 150 foreign engineers or other specialists participated in Bureau training programs in the United States. Simultaneously, advisory services were provided 15 countries. At the close of the year, approximately 60 Bureau employees were on oversea assignments under the Foreign Activities Program.

Nine Job Corps Conservation Centers operated by the Bureau of Reclamation under the Office of Economic Opportunity's Youth program speeded natural resource conservation. Their primary purpose was the conservation of a most valuable asset—young men.

Residents in the localities benefited greatly from their work. The corpsmen developed numerous recreation areas on Federal land by building roads, clearing underbrush, and constructing picnic tables, restrooms, boat ramps, shelters, outdoor fireplaces, and other facilities. One center established a nursery of tough, hardy grass which will later be planted on sand dunes encroaching on agricultural lands. Corpsmen planted thousands of trees, shrubs, and flowers to control soil erosion and to beautify their own camp areas.

Participating in the activities of nearby neighboring communities, corpsmen won the respect and gratitude of the townspeople by helping in cleanup jobs after blizzards, a flood, and a tornado.

Forty percent of the camp enrollees' 40-hour week was spent in work programs, but the corpsmen volunteered many additional hours to aid community projects.

Another 40 percent of the Job Corps 40-hour week was allotted to education and vocational training. Since the programs began, 226 corpsmen have been graduated and have entered the Armed Forces, have gone to full-time jobs, or have continued their education. At year's end, approximately 1,500 young men were enrolled in Bureau-sponsored camps.

In April 1966, the Secretary of the Interior transmitted to the President a report charting a cooperative research effort between government and industry to develop efficient, economic transmission of electric power at high voltages underground over long distances. The report, prepared by a group of nationally-known Department of the Interior engineers, recommended that overhead transmission lines not be permitted within a radius of about 30 miles of our most important cities.

Considering only the most populated cities, approximately 3,000 miles of transmission lines would need to be placed underground. Based on present technology, this would involve investment of about $1.5 billion. A five-year Federal research program of $30 million was recommended in the report.

Office of Saline Water

The 1965 drought that plagued the northeastern United States, coupled with awareness of the time when additional sources of water will be needed in other sections of the Nation, acted as a continuing spur to the Office of Saline Water (OSW) in its search for economically feasible methods of converting saline waters to fresh.

At the same time, new plateaus were being reached in the desalting field and the emphasis shifted to development of plant "hardware." Attention also focused on the economies of desalting and how they compare with the cost of water from other incremental sources of supply. Sufficient facts for making necessary comparisons are not yet available, but such information is being gathered.

Actual operating experience and proven economic data need to be provided to municipalities, industries, and others that require additional water. They need such information to determine which source of additional water is the most satisfactory in terms of capital investment, cost of water, quality, reliability, and so forth. Just as desalting is compared with alternative sources and costs, so must the many different types of desalting processes also be compared to determine their applicability in a given instance.

Dramatic reductions have been effected in what had been estimated to be the costs of water produced from large-scale plants, and work will continue toward even lower costs.

One of the greatest challenges now is to develop for small- and medium-size plants the anticipated economies predicted for large-scale operations.

Short-, intermediate-, and long-range goals have been established and the program is under continual review to identify what must be done to reach specific objectives. There can be no scattergun approach.

The short-range goal is for processes and plant designs to provide the lowest possible desalting costs at the earliest possible date, using the best available technology to bring economical water to areas needing it immediately.

The intermediate-range target is to develop, through experimental pilot plant operations, new technology to be used in the 1972–75 time frame. There would be some correlation between the short- and medium-range programs, but here the time would be provided to continue work with processes still experimental in nature, but which appear to have good potential if developed further.

The long-range program is centered on basic research, through which OSW hopes that entire new processes for desalting may be developed. Information gained from these studies will be applied as rapidly as it becomes available, but such studies are not expected to have any great impact on the program until 1975 or beyond.

The Office of Saline Water is steadily increasing the resources it devotes to engineering and development to assure the fullest possible use of all currently available technology. Basic research is not being curtailed, but no longer is it the main focal point of the program as it was during the early years. Rather, it is a companion effort which strives to add new knowledge while, at the same time, it works at broadening the application of current knowledge.

During the year there was increasing evidence of the constantly growing interest among people all over the world in new sources of fresh water and in the role desalting will play supplying future needs.

Perhaps the greatest display of worldwide interest in desalting and its thirst-relieving potential came in the form of the First International Symposium on Water Desalination held in Washington in October 1965. The auditoriums in the Department of the Interior and the Department of State were filled to overflowing at virtually every session by the 2,500 delegates, observers, and visitors from the 55 participating nations. The week-long session brought together in one city the world's foremost experts in the field of desalting.

Delegates were welcomed by Secretary Udall, who challenged them to "think in terms of a worldwide cooperative effort to solve the problems of desalting in the shortest possible period of time."

The Secretary added:

"Working together, we can assure that nations and cities will have a choice in their search for the best and cheapest source of water; that every country can have abundant, reliable, and reasonably priced pure water.

"A thirsty world is watching this assembly. Science and technology can find economic ways to desalt water. I am confident that this conference will lead to accomplishments of great significance to every person on our planet."

During the week, delegates went to the White House on the invitation of President Johnson to witness the signing of an agreement between the United States, Mexico, and the International Atomic Energy Agency. Under the agreement, a far-reaching study will be made of the possibility of using saline water conversion to augment present water resources of a wide area in the Southwest United States and northern Mexico.

President Johnson used the occasion to point out that the United States supports a "Food for Peace Program" and an "Atoms for Peace Program" and then announced the beginning of a "Water for Peace Program." He said:

"Under this new program, we will join in a massive,

cooperative, international effort to find solutions for man's water problems."

He added:

"The need is worldwide, and so should be our effort to meet that need. Therefore, I call upon the nations of the world to join us in the creation of an international fund to bring the fruits of science and technology to all corners of a thirsty world. We ask other nations to join with us, now, in pursuit of a common objective—water for all humanity."

In line with his program of international cooperation, two visits to plants operated by OSW were arranged by the President during the summer of 1965. Nearly 30 ambassadors to the United States from governments throughout the world visited the 1-million-gallon-per-day sea water conversion plant at Freeport, Tex., and another group of 20 ambassadors visited the 1-million-gallon-per-day brackish water conversion plant at Roswell, N. Mex.

Congress, in two actions, widened and extended the authorization under which OSW operates. On August 11, 1965, President Johnson signed a bill, extending the life of the program through 1972 and adding $15 million to already authorized appropriation for fiscal 1967. In this bill, Congress took into account the need for long-range planning by setting an additional $185 million as the amount that may be authorized and appropriated between fiscal years 1968 and 1972.

In addition, wording inserted into the Anderson-Aspinall Act of 1961 will allow the construction of "modules," which are sections of prototype plants that simulate the operation of a complete plant to confirm essential design features.

As part of the expanded research and development work, plans were made for constructing a Saline Water Test Facility in San Diego, Calif. This facility will be used for testing modules, large components, and equipment items that could be used in sea water conversion plants of all sizes.

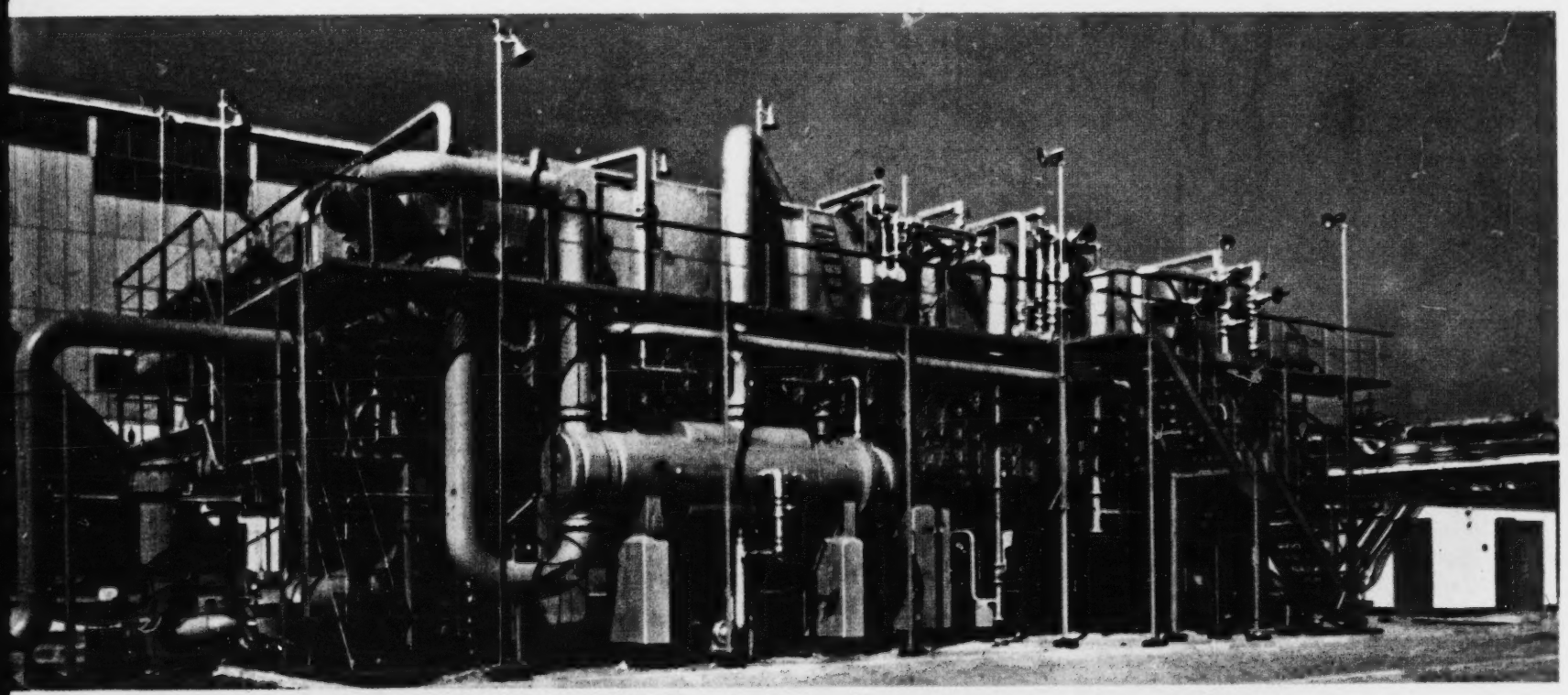
The test facility also will be the site of the 1-million-gallon-per-day improved distillation plant.

An interagency agreement was signed with the Atomic Energy Commission for research, engineering, and development services at Oak Ridge National Laboratory, Tenn. Under this agreement, ORNL will assist the Office of Saline Water by investigating components and design parameters for large plants. The work will include conceptual designs for future plants of up to 250-million-gallons-per-day capacity.

Considerable testing was done to determine the applicability of the promising reverse osmosis process to water purification problems other than straight conversion of sea or brackish waters to fresh. In cooperation with the Office of Health, Education, and Welfare, a 1,400-gallon-per-day privately constructed unit was operated on the Potomac River in Washington to determine its capabilities for removal of pollutants from water.

Following that test, the unit was utilized on the Hackensack River in New Jersey to get further facts on purification of polluted waters and then was operated for several weeks on acid mine waters at Kittanning, Pa., to determine its effectiveness in removing acids, iron salts, and other minerals from mine waters. The Kittanning testing was done in cooperation with Interior's Bureau of Mines and the Department of Health, Education, and Welfare.

Preliminary results were encouraging and final data on the results were being compiled at year's end.



Aquia — Chem., Inc. — Cleaver Brooks Co.

This long tube flash evaporator, part of the Aruba, Netherlands Antilles installation, will bring desalting capacity to 3,300,000 gallons daily. Worldwide efforts in desalination began to mesh in 1965 with the international conference called by President Johnson.

Bonneville Power Administration

Americans want more than just good electric service at reasonable rates. They are becoming increasingly conscious of aesthetics, creating new standards which the Bonneville Power Administration and other utilities must meet. The result may be a new America—one of handsome, uncluttered cities.

For more than 25 years, the Bonneville Power Administration based its structural design on three criteria: Function,

safety, cost. Early in 1965, BPA added a fourth criterion—beauty. And in June 1965, BPA hired a firm of architects to chart the new course in aesthetics.

In the year that followed, the architects studied BPA. They looked at many of its 270 substations and 9,600 circuit miles of transmission lines. They inspected projects still on the drawing boards. They examined its power operation plans for the future.

BPA's transmission lines are the sinews of a region. They carry energy across mountains, valleys, and deserts—in a necessary intrusion on the natural landscape on one of the most scenic corners of North America. The lines serve 5½ million persons in Washington, Oregon, Idaho, Montana west of the Continental Divide, and small, neighboring parts of California, Nevada, Utah, and Wyoming.

BPA's transmission system is the world's largest network of long-distance, high-voltage lines. These lines are used to market power from 21 Federal dams with a capacity of 6.7 million kilowatts. When eight more projects, still under construction, begin to generate electricity, BPA will also sell the power from these dams. In addition, BPA wheels and exchanges over its grid about 2.7 million kilowatts for other utilities. The grid contains 80 percent of the Northwest's high-voltage transmission capacity and supplies half the electric power consumed in the region.

The architects submitted their recommendations to BPA in June 1966, in a noteworthy report that stirred the interest and praise of the utility industry, and BPA began translating the report into action.

In a pilot project near the Pacific coast, a small substation was painted in soft color tones to blend with the scenery. The effect was pleasing and BPA now is painting other substations similarly. Designers began to lay out "low-profile" substations and to concentrate on improving the appearance of facilities.

On transmission rights-of-way, stumps are being cut flush with the ground. Grass, deer browse, and low-growing native shrubs are being planted. Water bars are being built to prevent soil erosion. Landowners are being encouraged to plant some rights-of-way to special crops, such as Christmas trees. Plans are underway in other locations to soften with low vegetation the severe, straight lines at the edge of transmission corridors.

New plans are scheduled for control and maintenance buildings, ground cover for yards, signs, flagpoles, microwave towers, lighting, and even trash barrels. Some yards are being screened with trees. Others will be built below ground level. As BPA strives to become a better neighbor, even the hum created by large transformers is getting close attention.

The Celilo Converter Station was one of the first projects to feel the impact of "beautility." It will actually be attractive to passersby. The station will stand on a high bench above the Columbia River near The Dalles, Oreg. The view it commands sweeps for miles, covering Mt. Hood, the city, the broad trench carved by the river, and the bare, brown hills to the east and north.

BPA's program of aesthetics is a new dimension in community responsibility. On a long-range basis it will not result in significantly higher construction costs, except where technology may permit big lines to be placed underground.

Line construction crewmen tighten a cable supporting a guide mast tower for the Pacific Northwest-Southwest Intertie.

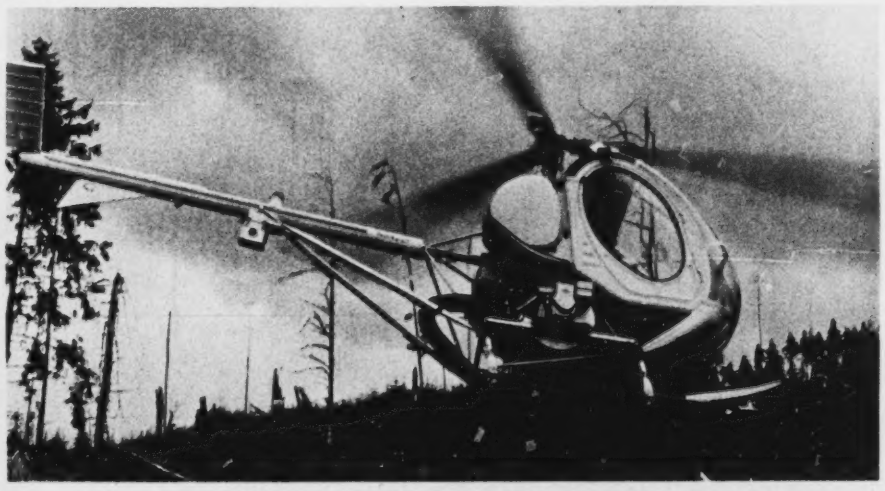
(Above) A little girl fishes below Ice Harbor Dam, Washington—one of 21 projects for which BPA markets electric power. (Below) This huge reel of conductor for the Intertie slowly plays off aluminum cable, which is raised and attached to transmission towers under tremendous tension.

BPA is finding that lower costs often result when the appearance of an electrical installation is streamlined.

The new emphasis on appearance is timely: It comes in the midst of the largest construction program in BPA history. BPA has about 1,500 miles of transmission lines under construction. During 1966, total cost of the such projects then in progress was approximately $100 million, down slightly from 1965, when the total was $125 million and included the $26 million terminal for the Celilo Converter Station.

Lines for the Pacific Northwest-Pacific Southwest Intertie are part of this construction program. The Intertie consists of four major transmission lines from the vicinity of The Dalles Dam and John Day Dam to Los Angeles and Hoover Dam. Various sections will be built separately by private and public utilities and the Federal Government.

In connection with the first of the four Intertie lines, two historic contracts were completed with Portland General Electric Co. One provides for 50–50 sharing by BPA and PGE of capacity in the first 500,000-volt line through Oregon until May 1968, when other BPA and PGE lines for the Intertie will be available to carry power. The first 500,000-volt line is to be in operation from John Day Dam to the California border by October 1967.



Seeding rights-of-way with forage crops for game is one of Bonneville Power Administration's tasks. A helicopter takes off with a full load of grass seed for a transmission corridor in Western Oregon.

The other contract, the first of its kind for BPA, is a trust agreement for joint ownership by BPA and PGE of the 500,000-volt switching installation at Grizzly substation in north-central Oregon. When the contract was signed, PGE delivered a $150,000 check to BPA as the first installment on a joint facility to cost about $1,250,000. BPA is designing and building the station. The arrangement is an example of the new approach through which the Federal Government and a private local firm combines money, skill, and energy to reach a mutual goal.

The second 500,000-volt alternating current line from John Day Dam to the California border is to be completed in 1968. BPA expects to complete its portions of the two 750,000-volt direct-current lines in 1969 and 1971, respectively.

When these lines and their southern portions are energized, they will permit the exchange and sale of surplus Northwest secondary energy and peaking capacity in California and other Southwest States. The Intertie also will be used to "firm up" with Southwest power, a large block of Northwest power which otherwise would be available only when river flows are up. BPA expects to net $10 to $12 million a year from these transactions.

Another example of joint approach to mutual problems occurred when BPA energized a new 70-mile, 500,000-volt line from Arlington to Blaine, in Washington State. At Blaine, a small city on the border with Canada, the line connects with one built by the British Columbia Hydro and Power Authority. The connection is the largest extra-high voltage transmission link between two nations

The line will enable BPA and BC Hydro to exchange large amounts of power. It will be useful in emergencies such as one in 1963, when lightning knocked out two 360,000-volt lines serving Vancouver, British Columbia. BPA sent emergency power north over a 230,000-volt tie built in 1947. Emergency assistance works both ways. In 1965, an earthquake interrupted service on four big lines serving the Puget Sound area. BC Hydro sent emergency power south. On both occasions major power outages were avoided.

BPA has completed several sections of 500,000-volt line, and during 1966 it was building another 700 miles at this voltage. Congress has authorized another 243 miles. All will be part of the new 500,000-volt grid BPA is creating to overlay its present system. By 1975, BPA will require 1,600 miles of 500,000-volt lines, exclusive of the Intertie.

The grid, with its ties to BC Hydro and to the Southwest via the Intertie, will be a key link in a complex of lines that by 1968 will provide a 1,800-mile electrical path from northern British Columbia to the Mexican Border.

Electricity from the world's largest nuclear generating plant began flowing into the BPA system in commercial quantities April 8, 1966. It was produced with byproduct steam from the new production reactor at Hanford Atomic Works in a generating plant built by the Washington Public Power Supply System. The plant has two 430,000-kilowatt generators. The first unit went into commercial production in April and the second in June. BPA delivers Hanford power over its grid—half to public and half to private utilities—under exchange agreements among WPPSS, BPA, and 76 participating utilities and industrial firms, still another example of the new direction in joint undertakings.

The Pacific Northwest is building more dams and installing more generating equipment than at any time in the past. Twelve hydroelectric projects—eight Federal and four non-Federal—are under construction. Combined, they will have the capacity to produce more than 6 million kilowatts.

One of these is Libby Dam, which will back Kootenai River water 42 miles into Canada. It is being built by the Corps of Engineers under an option given the United States by the Columbia River Treaty.

Three other treaty projects are underway north of the international boundary. These Canadian storage projects will largely eliminate the disastrous floods that have occurred on the Columbia. They will add some 2.8 million kilowatts of dependable capacity at U.S. dams downstream. Canada and the United States are to share this power equally, and Canada has sold her share to utilities in the United States for 30 years.

Progress on the Canadian projects during 1966 was impressive. The summer construction season, the second since the treaty was implemented, saw more than 2,650 men at work on

the three dams. All three projects—Arrow, Duncan, and Mica Dams—are either on or ahead of schedule.

Duncan Dam is to be completed in April 1968, Arrow in April 1969, and Mica in April 1973.

Federal power continues to contribute strongly to the economy of the Pacific Northwest. BPA now serves directly 22 industrial plants. They had 13,000 employees in 1965, and paid $92 million in salaries and wages and $8 million in State and local taxes. They bought $37 million worth of BPA power and $75 million worth of Northwest supplies and materials. Their freight bill totaled $44 million. Their investment in capital additions totaled $67 million for the year. For every person directly employed in these plants creates jobs for two other workers in allied or supporting industries.

The demand for industrial power is quickening. Since May 1964, BPA has sold or promised to deliver 1,424,000 kilowatts of firm power, which will add some $23 million annually to BPA revenues.

Unless BPA's all-hydrogenerating resources are supplemented with steam-generated energy, or some other adjustment is made, it may have to display a "sold out" sign as far as new industry is concerned. Studies show the region will need more than 10 million kilowatts of new steam capacity by 1985. Ideally, the first new thermal plant should be in production by 1971 or 1972.

BPA is consulting with its customers to determine who will build these plants and to assure they are built in the right location, of the right size, and at the right times.

Southeastern Power Administration

Southeastern Power Administration (SEPA), which marketed power last year to 88 rural electric cooperatives, 60 cities, 2 State agencies, 5 private power companies and the Tennessee Valley Authority, is deeply involved in multipurpose project planning. Its concern is not only with specific projects, but with the broader aspects of basinwide planning. SEPA is participating with other Federal units and with State agencies in comprehensive basin studies for the Ohio, the Kanawha, the Wabash, the Big Black, and the Pearl and Pascagoula River Basins, as well as the work of the Water Development Coordinating Committee for Appalachia, which has both Federal and State representatives.

SEPA also represents the Department of the Interior on the Southeast River Basins Inter-Agency Committee, composed of representatives of seven Federal departments and agencies, three States, and one interstate group. The Committee seeks to coordinate the policies and activities of the States and Federal agencies in the field of water and related land resources, to provide means for resolving conflicts, and to avoid conflict of interest with all agencies in this field.

SEPA's primary concern is hydroelectric power development. However, it seeks to keep power development and power operations from interfering with other worthwhile public purposes, as long as such other purposes are able to assume an appropriate share of costs otherwise chargeable to power.

SEPA's $27 million annual revenue comes from sale of electric power from a base of 1.7 million kilowatts of installed capacity.

Southwestern Power Administration

The six-State region served by Southwestern Power Administration (SWPA) has weather conditions ranging from semiarid to subtropical. Average annual precipitation varies from 60 inches in Louisiana to 18 in western Oklahoma. Against this varied climatic backdrop, SWPA has found that cooperative planning of water resource development gives the region its highest return from hydropower and other water related resources.

To this end, SWPA engages in comprehensive river basin planning with other Federal and State agencies, interested private organizations and local government units.

Multiple-purpose projects help conserve our fossil fuel with their power generation function, provide power storage pools of greater area but with a minimum of annual fluctuation, and stabilize downstream riverflow. This latter function adds to the natural beauty of the areas and makes the waters more attractive for recreational use.

A prime consideration in SWPA planning for future hydro-

Power from four generating units of 50,000 kw each is produced at Table Rock Dam in Arkansas and marketed by Southwestern Power Administration. The multi-purpose project was built by the U.S. Army Corps of Engineers.

generation and transmission projects is America's need for wholesome water-based recreation and unspoiled natural beauty.

SWPA is responsible for transmitting power over 1,500 miles of lines. Its $21.3 million annual revenue comes from power sales based on 1.3 million kilowatts installed capacity.

Bureau of Commercial Fisheries

A year of achievement by the Bureau of Commercial Fisheries foreshadowed great future developments in the Bureau's efforts toward conservation—of the seas'riches and of the lives of the world's hungry millions.

One of the most significant achievements was the research progress with fish protein concentrate (FPC). The Secretary of the Interior petitioned the Food and Drug Administration to approve FPC as a food additive explaining that Bureau scientists had worked 3 years to develop procedures for manufacturing a nutritious and completely wholesome product. The results of the research were reviewed late in 1965 by the National Academy of Sciences. On December 1, 1965, the Academy informed Secretary Udall that, in its judgment, "fish

Miracle in the making—Fish protein concentrate

Operator drops hake into grinder, a process producing "fishburger."

By mixing the fishburger with alcohol, water and fats are removed.

Solids are separated from liquids and are dropped into the container.

Fine grinder reduces fully dried FPC to the desired particle size.

protein concentrate, from whole hake, as prepared by the Bureau's process is safe, nutritious, wholesome, and fit for human consumption." The last remaining questions before production of FPC could begin were being resolved.

The Department supported legislation authorizing it to develop practicable and economic means for the commercial fishing industry to produce FPC. The favored means was through the construction of a large-scale demonstration and experimentation plant that would be based on research findings of the Bureau's model-scale unit at Beltsville, Md., near Washington, D.C. Here in this small facility scientists using a solvent extraction process developed a virtually odorless, tasteless substance that looks like light-gray flour and is 80 percent protein and 20 percent nutritionally beneficial minerals.

Researchers found that the concentrate blends well with other forms of food. It was successfully tested as an ingredient in beverages, noodles, gravy, bread, and cookies, and thus would lend itself well to increasing the nutritive value of native dishes of any country.

FPC can contribute much to ending "protein starvation," the most urgent food problem of the century for about two-thirds of the world's population. Studies show that if only the unharvested fish in U.S. coastal waters were made into the concentrate, it would provide the additional high-quality protein to balance the diet of 1 billion people for 300 days at a cost of about a half cent per person per day.

Because this contribution to the conservation of man depends on the conservation of the ocean's resources, the Bureau speeded its study of this latest great source of food. It also worked with all conservation-minded fishing nations to insure that the ocean would not suffer the fate of much of the land—mismanagement and despoilment.

The work of Bureau researchers established that the sea could easily support a harvest about six times the current world catch. Much of the additional harvest would be in species now utilized only in small amounts or not at all. Today, only about a dozen species are fished intensively by the United States, mostly because they are the ones consumers have become accustomed to eating. Fishing by U.S. vessels is restricted to a relatively small part of the sea. Edible species like hake and squid are tossed back, while some salmon and tuna are overfished.

Over half the additional catch would come from waters within 12 miles of the U.S. coast and from interior waters. Within these 12 miles, Pacific waters would supply over half; Atlantic and Gulf, about one-third; and lakes and streams the remainder.

The Bureau received nearly $20 million in fiscal 1966 to study the sea and its riches. While its oceanographic research tried to solve immediate problems of the fishing industry, its goals were primarily long range. Scientists aboard modern oceanographic vessels sailed from biological laboratories at Woods Hole, Mass.; Miami, Fla.; La Jolla, Calif., Honolulu, Hawaii.

They studied species of fish off all coasts of the United States, and collected information on the size of fish resources, rates of decline or increase, and the effects of large catches on fish populations. They sought to understand the in-

The light gray, odorless FPC flour (above) was used in preparing all the breads, doughnuts, cookies, soups and main dishes shown below.

terrelationships between major aquatic resources and their environment, and to gain new knowledge of the natural phenomena of the oceans, coastal waters, and estuaries.

The oceans are open to the vessels of all nations beyond a narrow belt of coastal waters a few miles wide. Unrestrained competitive fishing in international waters may severely damage important resources. The Bureau has long sought to prevent overfishing in some valuable species through its work for international commissions set up by agreements between nations. It favored strengthening the role of the Food and Agriculture Organization in world fisheries—and tasted success when the FAO elevated its Fisheries Division to Department rank.

To conserve Atlantic tunas, the United States met in Rome with Brazil, France, Japan, Nigeria, Portugal, and Senegal. Participants agreed to cooperate to maintain the tuna population at levels that would permit a maximum catch year after year without threatening the resource. They recommended that an international convention be established to carry out their objectives. The commission would conduct biological research on stocks of tuna, on fishes commonly used as tuna bait, and on other kinds of fishes caught along with tuna.

The International Convention for the Conservation of Atlantic Tunas was drawn up at a Conference of Plenipotentiaries convened by FAO in Rio de Janeiro in May 1966. Three nations, Brazil, Spain, and the United States, have already signed.

To conserve the tunas of the eastern tropical Pacific, the United States conferred with other members of the Inter-American Tropical Tuna Commission—Costa Rica, Ecuador, Mexico, and Panama—and recommended a total yellowfin tuna quota of 79,300 short tons for 1966 to the governments of participating nations. Experts believed this quota would restore the resource, now being overfished, to its maximum productivity of 91,000 tons in about 3 years.

To protect the king crab in the eastern Bering Sea, the United States, Japan, and the Soviet Union signed an agreement limiting Japanese and Soviet catches. Biologists of the three nations boarded each other's vessels to observe and sometimes to assist in the operations. The nations agreed to intensify their study of the resources in the eastern Bering Sea and to exchange scientific personnel and data, including estimates of maximum catch.

The United States met with 12 nations in Canada to consider the effects of the increased fishing effort on the Northwest Atlantic fishery resources. Fishing intensity on cod and haddock resources had reached, or exceeded the maximum sustainable yield. The nations agreed that catch quotas, in addition to existing mesh regulations on trawl nets, were the most feasible type of regulation.

The International Whaling Commission, of which the United States is a member, met in London and agreed unanimously to set a quota for the Antarctic of 4,500 blue whale units in 1965–66 and to reduce the catches further in 1966–67 and 1967–68 to prevent continued overfishing. It also voted to prohibit the killing of blue whales in the North Pacific for 5 years beginning in 1966 and humpback whales in the North Pacific in 1966.

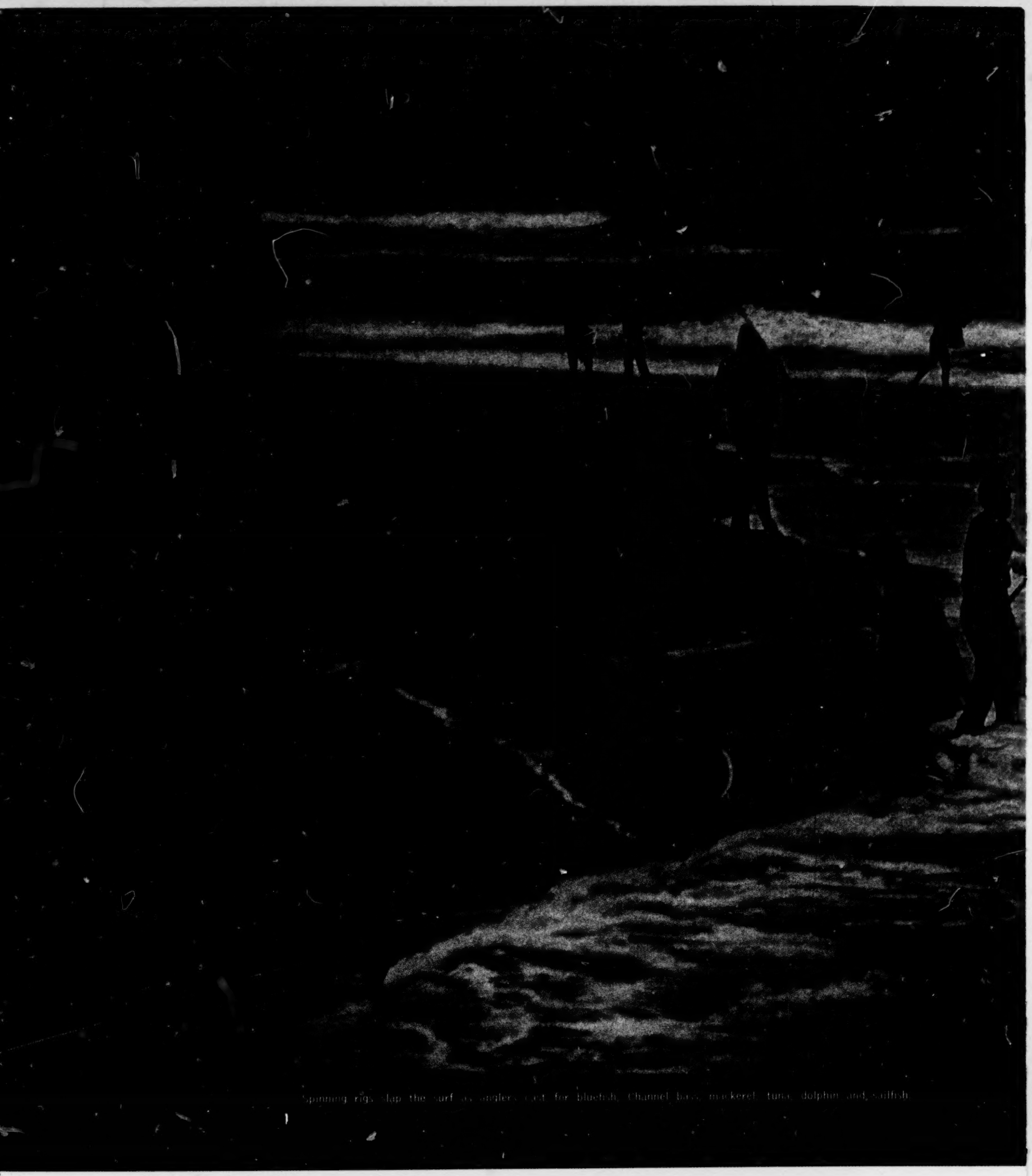
On our own shores, the struggle for conservation proved equally difficult. No other area of our environment is being threatened as severely as the estuary—the place where the ocean's salt water meets the land's fresh water—one of the Nation's greatest resources.

The U.S. coastline, with all its indentations, is more than 50,000 miles long. Commerce leaves and arrives here, many great industries are based here, and about 30 percent of the population lives within 50 miles of the coastal region, where population growth is greatest. A half million people make a living from commercial fishing; sport fishermen, waterfowl hunters, boaters, swimmers, and nature lovers find recreation here.

It is in the estuarine waters along the coast that at least 7 of the 10 most valued species in commercial fisheries and most of the marine sport fish species spend important parts of their life cycle. The estuary is home to a wondrous collection of terrestrial and aquatic life. It is an area of constant change. Nature alters it by storms, tides, and invasions of animals and plants. But man has had by far the larger impact. Nearly everything he had done along the coastline has damaged estuarine areas.

Expansion of industry, mushrooming residential developments, and merging of metropolitan centers into megalopoli have altered many estuaries profoundly. Others are used as dumps, landfills, and monstrous septic tanks.

Population growth will increase industrialization and urbanization. More powerplants will be built, including steam and atomic plants that need great quantities of water for cooling. They will return the heated water to the rivers and

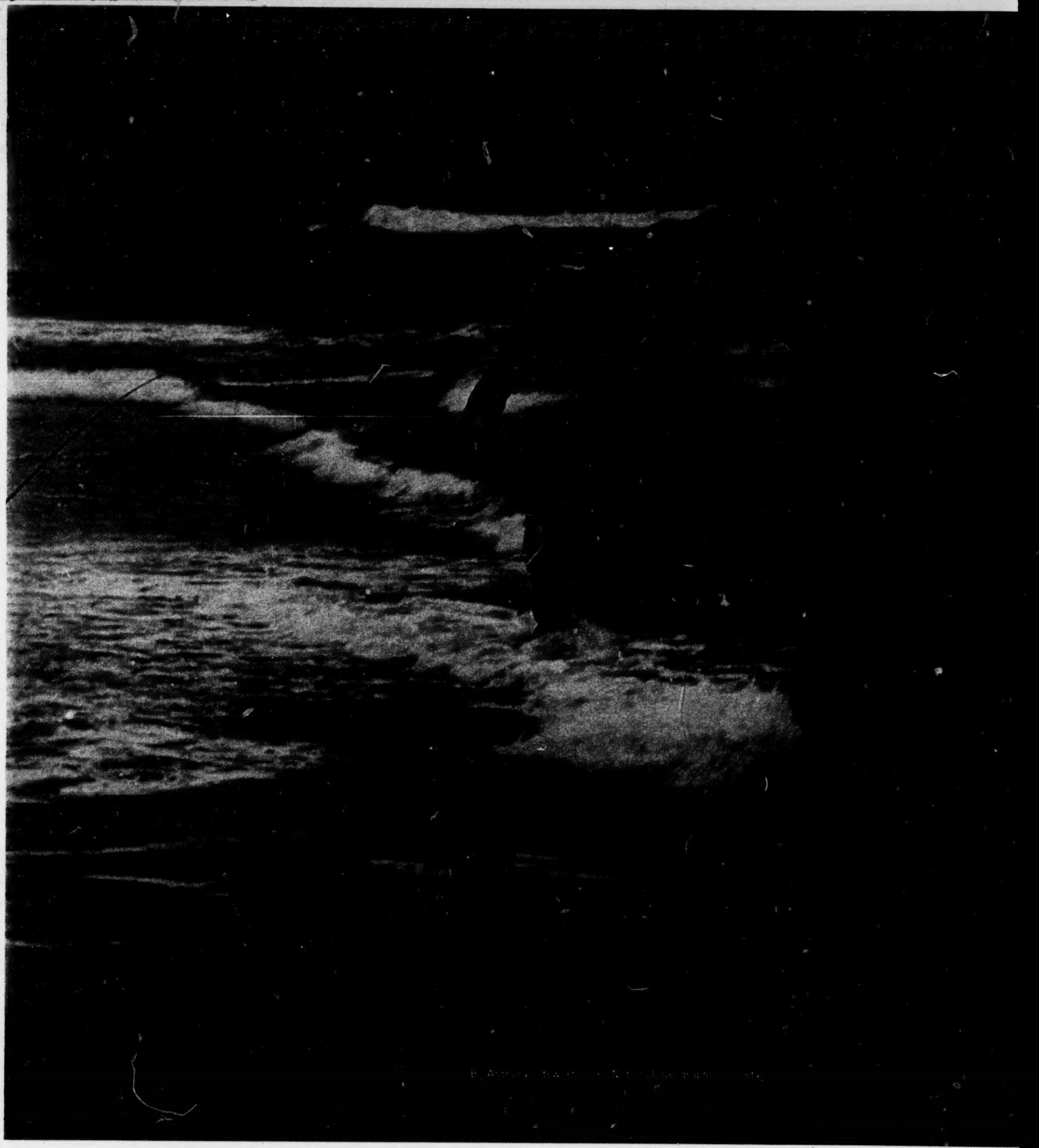


Spinning rigs slap the surf as anglers cast for bluefish, Channel bass, mackerel, tuna, dolphin and sailfish

streams, changing aquatic resources and their environment. Inevitably, thermal pollution will become serious on the Atlantic coast. On the west coast, thermal pollution of the Columbia River already has raised water temperature at certain points to the maximum tolerable for salmon.

Although it had no regulatory power over the treatment of estuaries, the Bureau nevertheless sought to learn more about the effects of the dredgeboat, dragline, and bulldozer, and how to minimize their effects on estuarine life.

To develop this knowledge, scientists from 22 Bureau laboratories were involved in biological research along the coast on species related to estuarines. They sought to learn how many fish or shellfish any one part of an estuarine area produces and supports and how much area is needed to preserve

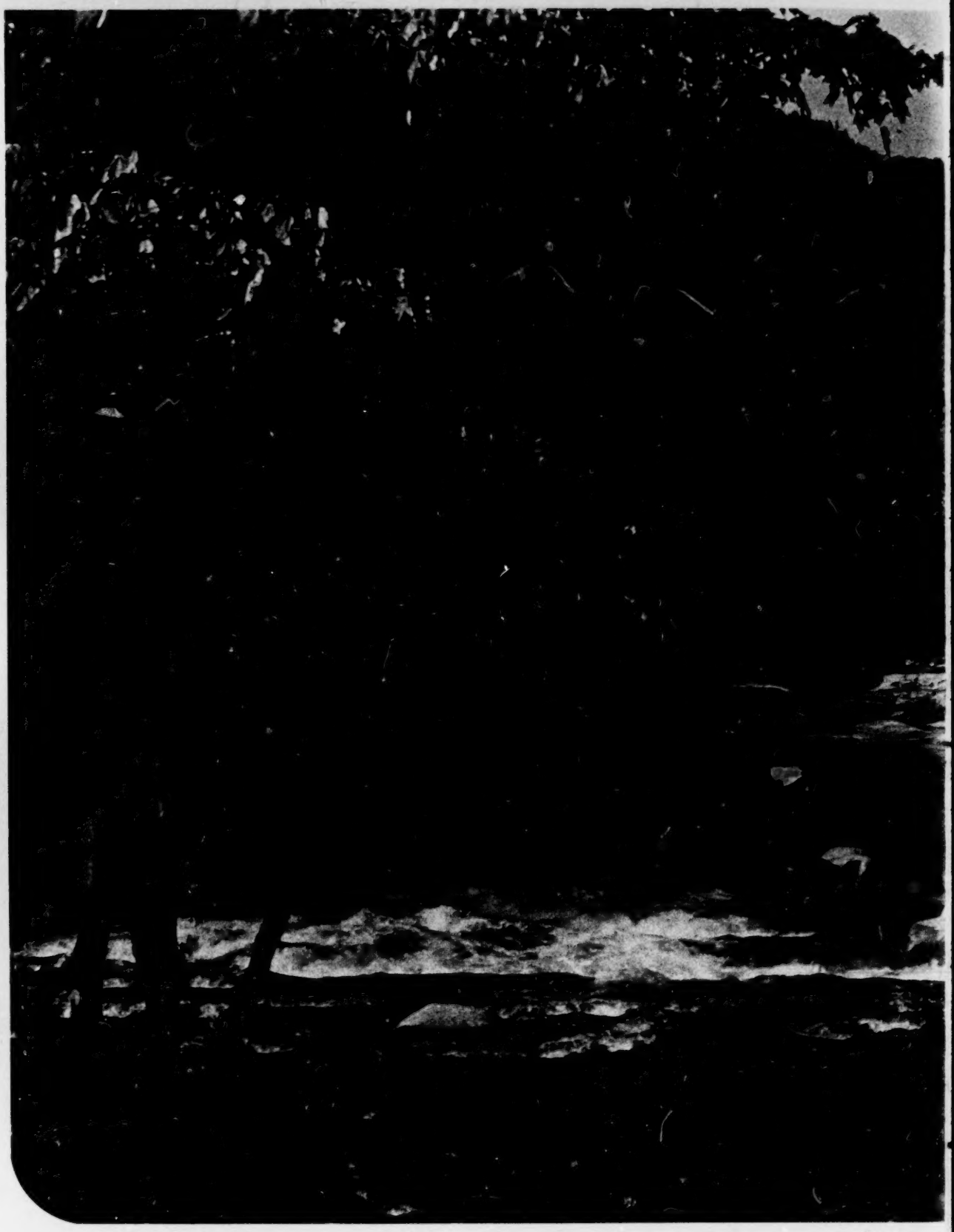


a reasonable population of certain resources, such as bass or menhaden; they conducted before-and-after studies to learn the differences between undisturbed and modified estuarine areas; they worked with river basin experts of the Bureau of Sport Fisheries and Wildlife to evaluate changes taking place in established fishery resources; they studied the construction proposals of Federal agencies and suggested ways to minimize adverse effects on aquatic resources. In addition, they worked with State fishery commissions in proposing and designing joint estuary studies, assisted the news media, talked to conservation groups, garden clubs, and other civic organizations, and testified at engineering hearings.

Bureau scientists participated in highly significant events:

A study by one biological laboratory led to alteration

Pacific Northwest development deprived salmon, shown jumping falls, above, of much habitat. Fishways, like the one below, keep spawning grounds open, salmon stocks high and fishermen happy.



of plans for a 500-acre fill in Florida that would have destroyed that many acres of prime nursery for aquatic life;

They presented arguments against a proposed 11,000-acre impoundment in Florida's Old Tampa Bay;

Their recommendations saved 20,000 acres of estuarine area in the proposed channelization of the Mississippi River; and

They won the diversion of water for estuaries from a massive Texas project that would have changed the entire coastline.

Researchers were further heartened by the fact that overall, dredgefill permits were not issued as readily in 1966 as in previous years.

To a greater extent than ever, States and communities recognized the Bureau's knowledge and consulted its scientists. With Bureau and State help, the oyster industry was restored in some areas and was able to make a start in others. Without authority over the State-managed industry, the Bureau made its contribution by improving culture methods and management techniques to increase oyster production. Culture work done at one laboratory alone was instrumental in starting 10 commercial hatcheries. The Bureau's Shellfish Advisory Service assisted States and industry in making better use of research information to manage and develop shellfish resources.

Agricultural chemicals have become an accepted part of the marine and coastal environment. In some cases they are applied directly to coastal marshes and bays to control mosquitoes, flies, weeds, and other pests. In others, they are washed in by rivers from treated lands, or blown by the wind from aircraft spraying.

Pesticides have particular significance for the fishing industry. Some of the most valuable species of fish and shellfish are also the most sensitive to pesticides. In minute quantities, pesticides will destroy or alter normal physiological functions of shrimp, oysters, clams, fish, and the microscopic plankton which are primary sources of food for these species.

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The Bureau, in cooperation with the Bureau of Sport Fisheries and Wildlife and the States, succeeded in having certain pesticides barred from use. It stepped up its monitoring program in estuaries throughout the Nation. About 200 sampling stations are seeking to learn which pesticides occur, in what concentrations, and what variations take place seasonally and over a period of time. They seek to trace any connections between the increase in pesticide content and such factors as the use of pesticides upriver. They also look for radioactive materials.

The Bureau's labors are handicapped by the absence of a basic plan for river basins and estuaries. No one State or even a group of States can preserve or protect sufficient areas to assure adequate conservation of valuable sport, commercial, and other estuarine resources.

To back up the Bureau's knowledge with strength, the Department of the Interior supported legislation that would give the Secretary broad authority to study, acquire, and administer a national system of estuarine areas.

Herculean efforts will be required if pollution of the estuaries by industry, States, and communities is to be overcome. Effective nationwide programs will depend on an informed and aroused public, acting to protect its heritage.

There is a brighter side to the pesticide story, illustrated by the remarkable comeback of the Great Lake trout. The sea lamprey made its way up the St. Lawrence River into the lakes and, by 1946, had reached the uppermost part of Lake Superior. By 1952, almost 100 percent of the trout taken in nets carried scars of lamprey attacks. The commercial catch dropped to nearly nothing and few lake trout were taken by sport fishermen.

Electrical barriers were installed in feeder streams while an intensive search for an effective lampricide was pushed. The search produced a chemical which kills young lampreys in very dilute solution but does not harm other fishes. For 3 years, chemical treatment and yearly restocking of about 2 million lake trout have been maintained with excellent results. Sport fishing has become attractive again, and the commercial potential has brightened.

To fulfill its farflung obligations, the Bureau continues to add to the tools and techniques of conservation: Research vessels and laboratories.

On the University of Michigan campus it opened a $1.4 million laboratory, where about 60 researchers and supporting staff are engaged in biological, technological, and statistical studies related primarily to lake, river, and reservoir fisheries of the United States. Scientists are cooperating with the States served by the Bureau's Great Lakes and central regional office.

The Ann Arbor laboratory houses the technical editorial staff serving all Bureau biological laboratories and serves as headquarters for the Great Lakes Fishery Commission, which includes members from Canada and the United States.

The Bureau recently opened on Virginia Key in Miami, Fla., the Tropical Atlantic Biological Laboratory, part of the world's largest tropical ocean science complex. The Virginia Key Campus of the Institute of Marine Science, University of Miami, was dedicated at the same time. This new installation is an expansion of the biological laboratory established in Washington, D.C. in 1958, and later transferred to Miami. The expanded facilities will allow laboratory personnel to continue investigations of tropical and equatorial Atlantic and its valuable resources of tunas and other fishes.

In Seattle, the Bureau set up a new unit in its existing laboratory to study problems produced by oxidation of fish oils. The unit is seeking ways to preserve fish on the long voyage from sea to consumer. Scientists are studying the oils while they are still in the fish, after they are extracted, and especially at very early stages of the normal storage period. Fish oils are used today to make pharmaceuticals, plastics, and chemicals. The European margarine industry provides a large market for fish oils.

Commercial fisheries worked closely with the Bureau of Sport Fisheries and Wildlife to plan a new Federal program to conserve and develop the Nation's anadromous fishery resources. Anadromous fish, such as striped bass, salmon, and shad, live in the ocean and return to fresh water to spawn.

The program was authorized by the Anadromous Fish Act, which provided $25 million through June 30, 1970, for re-

search, stream improvement, and construction of fishways, spawning channels, and hatcheries. Federal funds would finance up to 50 percent of approved anadromous fish projects. For fiscal year 1967, beginning July 1, 1966, each bureau was to have $2.5 million for loans to eligible States.

Conservationists saw far-reaching benefits to sport and commercial fishery resources. State agencies with fisheries jurisdictions would be able to enter into cooperative agreements with the Federal Government to carry out approved activities.

In the Columbia River region of the Pacific Northwest, the Bureau of Commercial Fisheries accelerated its programs to conserve the salmon and steelhead trout deprived of habitat by recent rapid growth of industry and population. The fish of the Columbia are of prime importance to the area's economy. A major factor in the region's development has been use of the abundant water of the Columbia for hydroelectric power, irrigation, inland navigation, and recreation areas. But Bureau surveys showed that farming, logging, and mining severely injured salmon and steelhead populations, and dams often formed impassable barriers.

To protect salmon and trout, the Bureau worked with the Bureau of Sport Fisheries and Wildlife, fishery agencies of Oregon, Washington, and Idaho, and with universities to study Columbia River fishery problems.

Bureau specialists worked to speed stream improvement, built fishways to bypass dams, and removed natural and man-made obstacles to the migration of adult salmon and steelhead. They built hatcheries, cleared obstructions from miles of tributary streams, and improved minor falls. They provided proper screening facilities to protect young, downstream-migrating salmon from being carried in irrigation diversion channels onto farmers' fields; and continued to seek methods to improve salmon and steelhead production and control their predators.

The new research vessel *David Starr Jordan* was commissioned in January 1966 at her home port of San Diego. The *Jordan* is a 171-foot, all-steel, welded vessel with a range of 8,000 miles at 12 knots, able to remain at sea up to 40 days. She carries a crew of 16 and a scientific complement of up to 13. She will be used for fishery research by the Bureau's California Current Resources Laboratory and Tuna Resources Laboratory, both housed at the Fishery-Oceanography Center on the University of California campus in La Jolla. The *Jordan* is equipped with the best available research sonar gear. Only two other research vessels in the world, both Norwegian, are similarly outfitted. This gear will make it possible to survey 500 square miles of sea per day and to evaluate fish stocks to a degree not previously possible.

The primary mission during the first year is to conduct surveys of anchovy eggs and larvae to establish the abundance of this commercially important fish.

The *Miller Freeman*, newest and largest vessel in the Bureau's growing research fleet, was launched at Lorain, Ohio, in April and was assigned to the Biological Laboratory in Seattle. It will be used for high-seas oceanography and fishery research in the North Pacific and Bering Sea. Its size will permit extended cruises to the stormy West Pacific. The vessel will also assist in carrying out provisions of the 1953 International North Pacific Fisheries Convention signed by the United States, Canada, and Japan. The convention concerns the catch and conservation of halibut, salmon, and some other resources—and the research necessary to meet international agreements.

The $3 million vessel, designed to carry a crew of 27, with additional quarters and facilities for 9 scientists, is a 216-foot, 42-foot beam, stern-ramp vessel, powered by a 2,150-horsepower diesel engine.

In its 96th year, the Bureau of Commercial Fisheries cast the longest and most vibrant line in its history. The line was being tugged by the possibility of reaping the greatest harvest ever given up by the sea—and of great contributions to the American commercial fisherman, the Nation's economy, and the hungry people of the world.

Bureau of Sport Fisheries and Wildlife

Animals can serve as barometers on the quality of man's environment. Can humans survive where wild creatures cannot? Who would willingly drink water too polluted for fish, breathe air too poisonous for birds?

Yet in most metropolitan areas, clean rainfall is channeled into sewers which flow fishlessly into the next city's water supply. We move in a miasmic mist along ribbons of asphalt where starlings fly but no quail ventures. Trees are cut for suburban building; marshes are drained to accommodate factories.

Most Americans have just begun to appreciate wild creatures as an integral part of living—to know that the cry of wild geese on a rainy night or the lonely call of a coyote drifting from a moonlit ridge can enrich life far beyond the everyday sounds of man's activities.

Hunting and fishing also add importance to wildlife resources. Once a table necessity, the pursuit of game has become an outlet in which the bag is subordinate to the chase, in which appreciation of surroundings is as important as a rod.

Even though enough is known about wildlife needs to assure fish in streams, birds in sky, and game in field and wood, man still faces the fact that "living space" for wildlife is rapidly diminishing. The major threats to most wildlife—pollution and vanishing habitat—are byproducts of present day "progress."

The fabric of life is woven in a complex pattern; man is fraying the edges and must exercise wisdom or he unravels the whole design. As the Federal wildlife agency, the Bureau of Sport Fisheries and Wildlife plays a key role in environmental research, and has learned that distant causes create near effects. Examples:

Waterfowl surveys in Mexico revealed that 10 to 20 percent of the continental duck popluation winters in or passes through that country. Much waterfowl habitat in Mexico's highlands has been lost, but good wintering grounds remain in the coastal marshes. As wintering areas north of the border continue to disappear, these coastal areas in Mexico become increasingly important to North America's wild ducks. Drainage of or drought on breeding sites in Canada showed dramatic effects on waterfowl here.

Selective cutting of timber in the Appalachian region was causing low production of browse, that shrubby vegetation

forming primary food for deer. The Bureau and the Forest Service found in a North Carolina study that cutting all trees (clear-cutting) in blocklike patterns may improve timber production while producing more browse. Clear-cutting also provides better grouse and turkey habitat.

The study of livestock fences and antelopes in Wyoming showed that pronghorns can clear fences 6 feet high—but that they rarely jump fences over 32 inches high. Thus 32-inch net wire (or 26-inch net with one barbed wire above) permitted antelope movement—and held sheep. This knowledge may help resolve joint use of the western range by antelope, sheep—and man.

Are Canada geese accumulating pesticides on their wintering grounds? Sampling of goose flocks last year showed only small amounts of chemicals. Even in fat, where residues concentrate, birds tested for DDT averaged 1.18 parts per million in Alabama, 0.48 and 0.43 p.p.m. in the Eastern Prairie and Mississippi Valley flocks—quantities not *now* considered a hazard. Pesticide levels in the whooping crane wintering area in Texas also were tested. Chlorinated hydrocarbon residues were low in such food items as angelwing clams, glass shrimp, blue crabs, chubs, mullet, shad, and killifish. Eggs of laughing gulls, roseate spoonbill, herons, and egrets nesting at Aransas likewise revealed low levels of DDE, and only traces of DDT, DDD, and dieldrin.

A study to prevent timber damage by mice, porcupines, beavers, hares, and deer produced promising new chemicals for field tests last year—*repellents* effective against a variety of animals which may cause damage and *poisons* selective for certain species.

Wildlife research was aided by automatic tabulation of 15 million cards regarding bird banding, game surveys, waterfowl breeding studies, and many other wildlife programs.

Studying habitat on waterfowl wintering grounds required a rapid sampling procedure reflecting natural and man-caused changes. The solution was TAPOM (timed aerial point-observation method)—a technique that records vegetative composition, land use patterns, and water conditions.

Studies continued on control of bats and their spread of rabies. Sea otter research found some 30,000 otters in Alaska waters and disclosed that in most areas the species is holding its own or increasing.

Fishery research is helping to satisfy the growing demand for angling. Selective breeding and hybridization produce game fish better able to live in polluted water, more resistant to diseases, or with more "fight" and color. Hybrids bred under Bureau Research programs may provide new opportunities for public fishing near big cities.

Research on reservoirs indicates that spawning and egg survival of prized species depends on the pattern of water releases from dams during critical periods.

Fish farming has assumed larger dimensions in the economy of several States because of fish farming experiments on Bureau stations in Arkansas. Thousands of acres in these States are being flooded to produce fish for sport and for market—while a base for conservation of game fish on the high seas was established in 1966 at a 17-nation conference in Rio de Janeiro.

In the last 400 years, 40 species and subspecies of America's wildlife have become extinct, largely because of changed environment. The process of extinction is speeding up:

(Above) Ogalla Sioux Indian children, Pine Ridge Reservation, view waterfowl habitat on Lacreek National Wildlife Refuge.

(Below) A copy of Waterfowl Tomorrow rewards sportsmanship of a graduate of the Junior Waterfowlers' Training Program.

(Below) Catchable-size brook trout are poured from a net at one of the 100 National Fish Hatcheries run by Interior.

Today, almost 100 varieties of birds, fishes, mammals, reptiles, and amphibians are threatened, from timber wolf to blue pike, from grizzly to Florida manatee, black-footed ferret, bald eagle, California condor. For years the Department has been protecting the bald eagle, key deer, whooping crane, trumpeter swan, desert bighorn, and Sonoran pronghorn. Now the efforts are being widened—are less defensive, more aggressive. The campaign is a broad program of education, research, legislation, enforcement, and environmental control measures. Research for endangered species is concentrated at the Bureau's Patuxent Wildlife Research Center near Laurel, Md., but other biologists, State and Federal, are working on the relationship of these animals to their environment . . . which is also man's environment.

Reflecting the Nation's growing concern for vanishing species of fish and wildlife, the 89th Congress in 1966 enacted legislation designed to provide additional safeguards for such resources. The new law authorizes a $15 million program for acquiring areas where threatened species will be protected. Enlargement of the Key Deer National Wildlife Refuge in Florida also was authorized.

The challenge is to manage wildlife populations for maximum public enjoyment while reducing conflicts. Animal control programs require exceptional finesse and sophistication. A Divison of Wildlife Services in Sport Fisheries and Wildlife handles the judicious chore of weighing the need for control against the social and esthetic values of wild things. For instance, coyotes must be managed to reduce losses to livestock. Yet a growing segment of the people "enjoys" these and other carnivores—such as bears and mountain lions—for hunting, for taking pictures, or just as "being there." Any new approach must satisfy these diverse interests.

Wildlife Services will perform two other functions: Enhancement of wildlife and pesticide surveillance.

The "enhancement" is to help improve public understanding of wild creatures and their habitat, from backyard birdbaths to wilderness. Humans who venture into remote areas, people who enjoy feeding pigeons in concrete canyons and suburbanites listening to mockingbirds . . . all are responding to wildlife.

Wildlife Services gives technical aid to Indians on management of reservation wildlife for improved hunting and for encouraging use by visiting sportsmen. Assistance is available to improve wildlife habitat on millions of acres of military lands.

The new division is seeking prudent use of pesticides, conducting surveillance operations on Federal lands, and participating in the national monitoring program on pesticides in the environment.

The primary objective of the Bureau's fishery program is to provide more and better angling through research. Aimed primarily at waters on Federal and Indian areas, the program provides guidance for holdings that make up 36 percent of the Nation's land and water areas.

Assistance in fishery management was provided last year to 350 Federal areas and Indian reservations containing 445,500 acres of ponds and lakes, plus 8,700 miles of streams, providing over 5 million man-days of fishing. An additional 4 million angling days were provided by assisted Federal-State projects.

Interest in angling is growing faster than our population, demanding better State and Federal work with fishery resources. States are linked by river systems, with compacts for uniform management and protection. Bureau biologists often coordinate uniform methods of gathering data to achieve joint solutions to pollution problems, and to help get public access for fishermen. Some restoration projects are so large that facilities of all agencies are needed.

The Bureau's fishery biologists participate with other Federal and State agencies in studies of the protection and restoration of water quality, including Upper Mississippi Conservation Committee activities, the lower Mississippi fishery survey, acid mine studies, strip and surface mine surveys, pesticide surveillance, fish kill data, and aquatic plant control.

In wildlife management, as in other fields, there is an endless need for facts born of well-designed research. Two activities in the Bureau produce capable researchers: The Cooperative Wildlife program and Fishery Unit program.

In 1935, the first Cooperative Wildlife Research Unit was established. Now there are 18 such units at land-grant universities, supported by the Bureau, the universities, State game and fish departments, and the Wildlife Management Institute. Some 250 graduate students now are being trained under this program.

The Bureau began its Cooperative Fishery Unit program in 1962. Twenty units have since been established, each involving the Bureau, a college, and a State wildlife agency. The objectives of the "unit programs" are to provide trained biologists who meet wildlife needs on a continuing basis, conduct research, and contribute to public knowledge. Students specialize in ecology, population dynamics, fish culture, taxonomy, diseases, and nutrition.

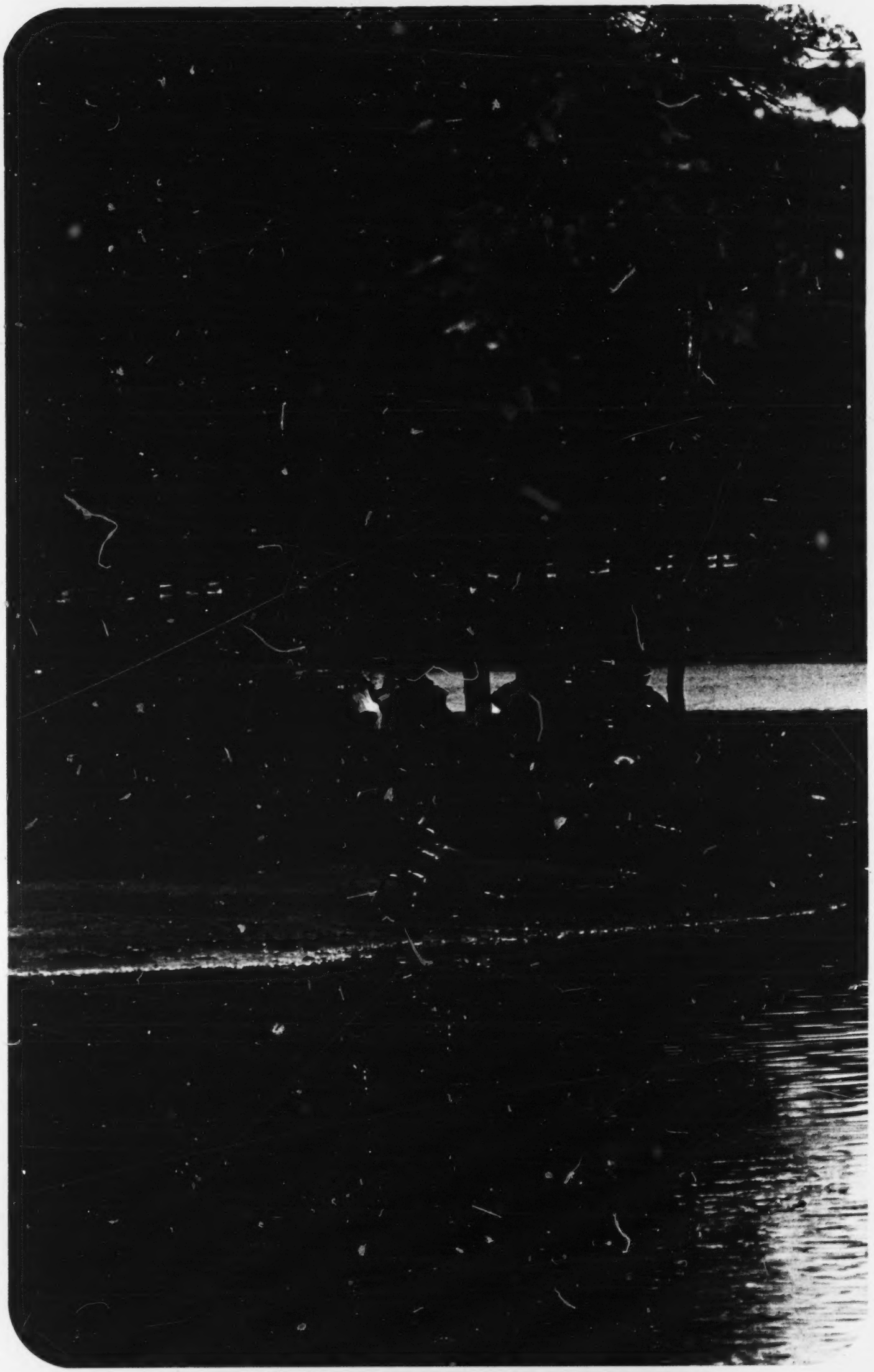
A major Bureau activity centers on waterfowl, many of which nest on prairie potholes gouged by ancient glaciers, breeding areas being destroyed by drainage. Stock pond construction in eastern Montana and Wyoming, western Nebraska, and North and South Dakota has offset some of these losses.

The National Wildlife Refuge system, begun 63 years ago, is primarily for waterfowl. Its 300 units, encompassing 28.5 million acres, are vital for ducks and geese, while the waterfowl resource is having difficulty holding its own against changing environment. Refuges have been dramatically successful with Canada geese in the Mississippi Flyway, where they are four times as abundant as in 1935. Human visits to refuges to observe wildlife have been increasing at even a more rapid rate.

Refuge techniques in handling rare species have brought encouraging results. Trumpeter swans were successfully transplanted from Red Rock Lakes in Montana to refuges in Washington, Oregon, Nevada, Idaho, Wyoming, and South Dakota. Desert bighorn sheep, plagued by lack of water, have spread and increased because artificial waterholes were created to catch rain on Southwest ranges. Whooping cranes continued their fight back from near-oblivion. Two new refuges in Oregon are providing wintering territory for two rare subspecies of Canada geese. In the case of the threatened bald eagle, refuges have proved their value. About 730 of the birds spent the winter of 1965–66 on 53 such areas.

But National Wildlife Refuges are also, in a sense, *human* sanctuaries. Some are being studied as wilderness areas.

John Alexandrowicz — PPG Chemicals Magazine



Fishing a leisurely sport? Ridiculous, say these energetic enthusiasts.

Development of "natural areas"—tracts of grasslands or timber, "ecological units" that form outdoor laboratories—has continued since the early 1950's. Additional areas under study include marsh sites.

These areas are for wildlife, but imaginative management finds many ways to make them serve "people purposes." No longer are refuges locked-up; the present annual total of 14 million bird watchers, hunters, photographers, anglers, and students who come to them soon will swell to more than 20 million.

The Bureau's responsibilities in supplying fish for stocking lakes and streams are increasing with the growing numbers of fishermen. The Bureau operates 100 National Fish Hatcheries across the country to stock places that cannot "naturally" keep up with angling pressures, and to provide for new or reclaimed reservoirs and ponds where initial plants of fingerlings are required. Production at National Fish Hatcheries is geared to changes in management concepts and tied in with State wildlife agency programs.

More than 2 million people a year visit Federal hatcheries. Small aquariums and visitor centers at some hatcheries offer an opportunity to become acquainted with native species. The Bureau works on fish rearing and disease studies with State and commercial producers; cooperative training programs have been established for research and testing.

Management of fish and wildlife resources is divided between Federal and State Governments. As part of its role, Sport Fisheries and Wildlife administers two State-aid programs.

The Federal Aid in Wildlife Restoration Act established cooperation with fish and game departments in "restoring, perpetuating, and managing" wildlife in a program financed from an 11-percent excise tax on sporting arms and ammunition, dividing about $17 million a year among the States to finance some 740 projects. Since 1938, $275 million has been apportioned to the States, Puerto Rico, Guam, and the Virgin Islands. Over 1,600 wildlife management areas totaling 50 million acres come under this program, virtually all of which is open to hunting. Most projects are on public lands, but an increasing number are on private holdings under cooperative agreements, leases, or easements. Such areas are managed to provide food, water, and cover; they range from habitat plantings to waterfowl impoundments. Stockings include antelope, elk, wild turkey, pheasants, deer, and exotic game birds.

Federal Aid in Fish Restoration is patterned after the earlier wildlife-aid program, authorizing Federal-State cooperation in restoring, perpetuating, and managing fish. Work began in 1952 with financing from a 10-percent excise tax on angling equipment. The average annual aid to States is about $6 million, used to finance nearly 400 projects.

Since its beginning, $75.5 million has been apportioned for benefits that include 222 fishing lakes with a total surface of 28,000 acres. More than 60,000 acres of land provide access to these and other waters at 949 developed sites. Such access has opened 2,257 miles of streams and 2.9 million acres of bays and reservoirs to anglers.

Still, water—its absence or abuse—is the gravest conservation problem in the United States today. Through a river basin group, the Bureau joins with other agencies in development of water and related land resources. A joint committee of Soil Conservation Service and Bureau personnel plans for multiple use benefits in small watershed projects; Sport Fisheries and Wildlife cooperates with the Bureau of Public Roads to protect resources in highway planning and thus preserve the fabric of life.

Last year, 196,000 acres for wildlife refuges were authorized at water resource projects, three-fourths of this in the Garrison Diversion Unit of North and South Dakota, which is prime breeding habitat for waterfowl to be acquired with Bureau of Reclamation funds. A 10,000-acre National Wildlife Refuge, part of the Bigstone-Whetstone project in Minnesota, will serve waterfowl in the central flyway.

Meanwhile preservation of estuaries and coastal wetlands is growing more difficult. These complex ecological zones, where fresh and salt waters meet, are the habitat of shellfish, finfish, birds—and humans.

The future still offers choices. Fishing opportunities can be expanded. "New" water and better hatchery techniques can provide places and fishes for angling. If pollution can be checked, aquatic deserts will again support life; abatement of mine pollution alone would restore 6,000 miles of streams and 15,000 acres of impoundments.

But satisfying hunter needs will be more difficult. Private landowners may need economic incentives before they will share land and game with other citizens. Public hunting areas will continue to serve their purpose, even if a point of diminishing returns in quality and quantity is reached.

Though damaged areas can be restored, research still is needed as to what should be done in relation to fish, game, and recreation.

An informed individual is the key to successful conservation measures. Conservation education must be expanded and programs aided by such legislation as the Federal Water Project Recreation Act, which is designed to increase the role of non-Federal public bodies in water resource outdoor recreation development.

Bureau of Outdoor Recreation

Established in 1962 as a result of recommendations by the Outdoor Recreation Resources Review Commission, the Bureau of Outdoor Recreation itself is a new dimension in conservation.

New patterns of living—propelled by greater urbanization, growing population, higher income, and more leisure—have brought a rising concern over the quality of America's environment and increasing demand for outdoor recreation. The Bureau of Outdoor Recreation provides a focal point and leadership in the nationwide effort to meet outdoor recreation demands.

The Bureau conducts planning to identify actions needed to protect the natural beauty and the quality of our outdoor environment and to provide outdoor recreation opportunities. It promotes coordination of Federal programs and assists Federal, State, local, and private efforts to reclaim and protect the out-of-doors and widen recreation opportunities.

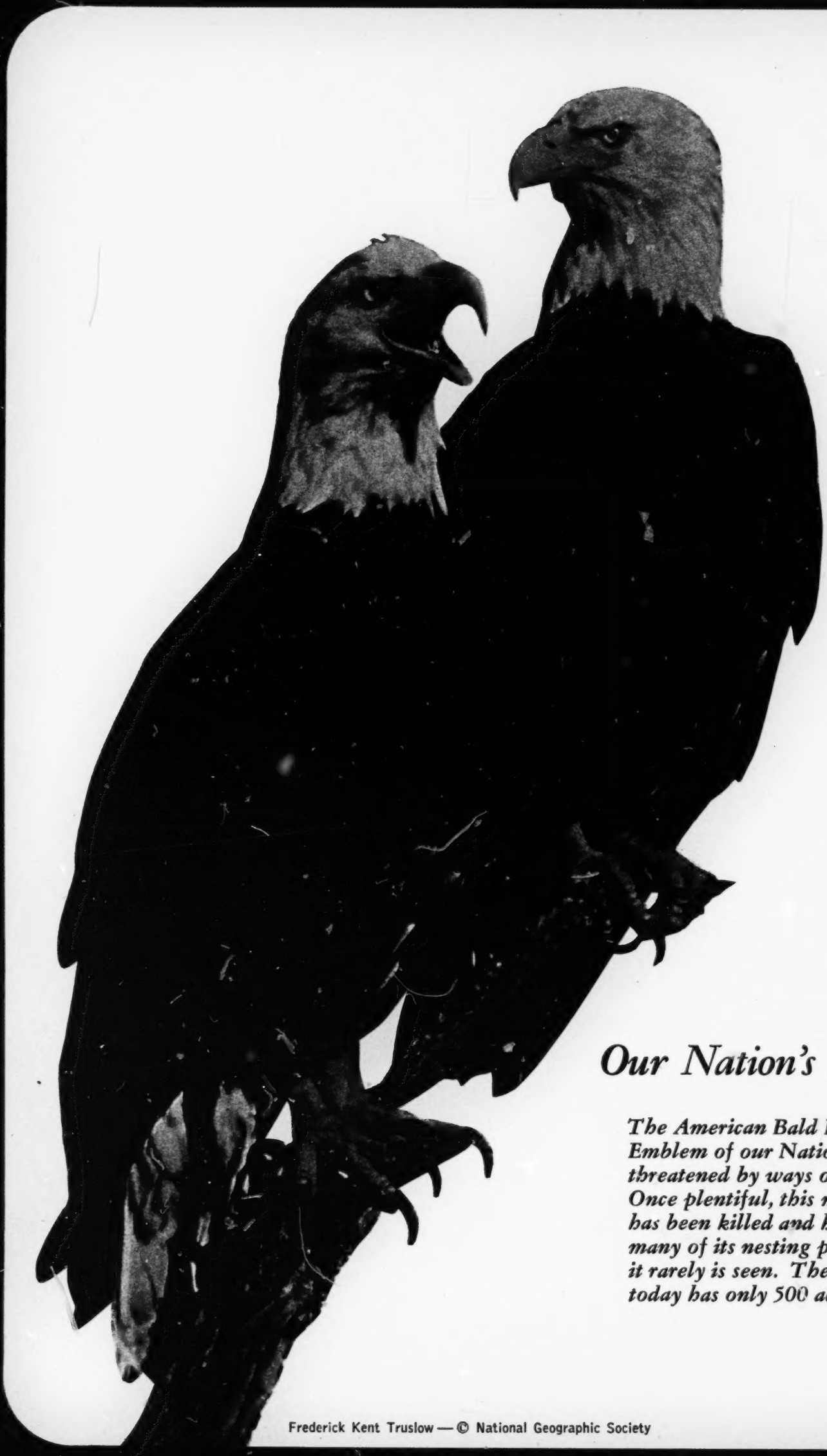
Concerns of the Bureau range from selling the $7 Federal Golden Passports—annual entrance tickets to our great national park, forest, reservoir, refuge, and other recreation areas—to restoring and improving the outdoor environment in urbanized America. (Continued on page 81)

Going . . . going . . . almost gone!

From Nature's chain, whatever link you strike,
Tenth, or ten thousandth, breaks the chain alike.

Alexander Pope "Essay on Man"

Grizzly Bear

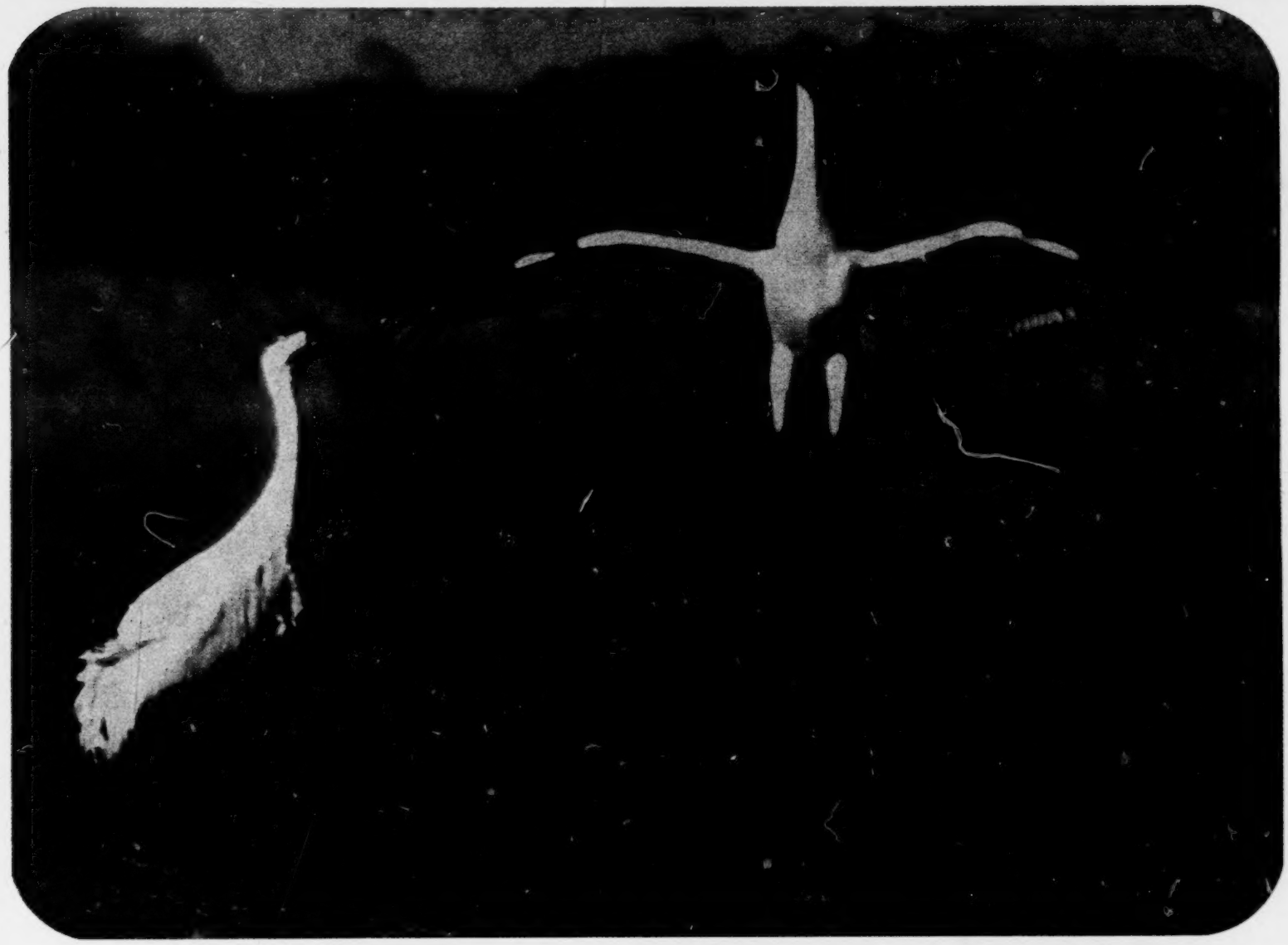


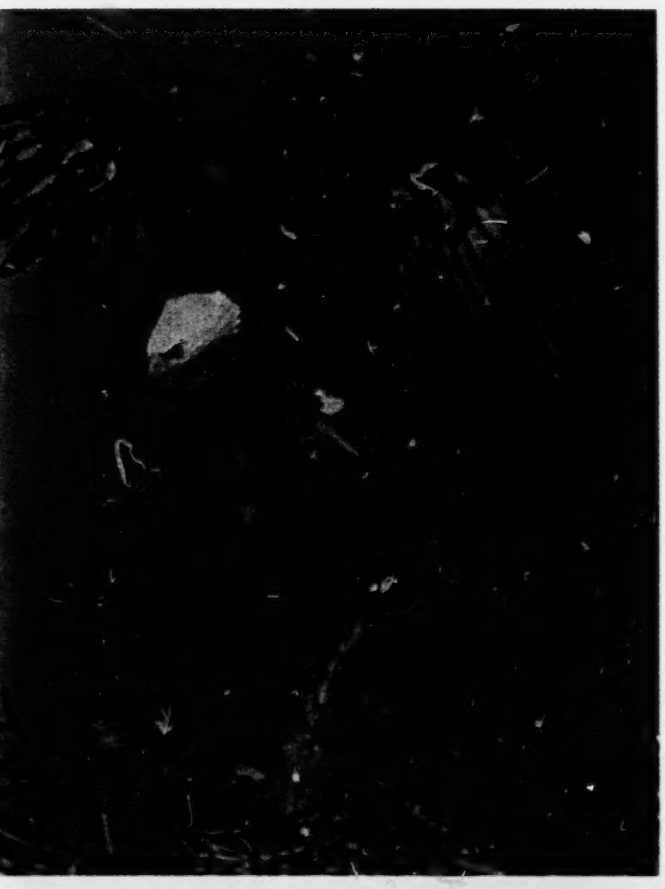
Our Nation's Symbol . . .

The American Bald Eagle
Emblem of our Nation
threatened by ways of man.
Once plentiful, this majestic bird
has been killed and has lost so
many of its nesting places that
it rarely is seen. The U. S.
today has only 500 active nests.

Frederick Kent Truslow — © National Geographic Society

Frederick Kent Truslow — © National Geographic Society





. . . the handsome Whooper . . .

Ungainly on land, but spectacularly beautiful when flying, the rare whooping crane (above) is barely holding its own. About 50 still roam the skies, less than one-fourth the number of satellites the U. S. now has orbiting the earth.

. . . the giant California Condor

Once ranging over several states in the west and south, the California condor now numbers about 50 and is found only in mountainous areas northwest of Los Angeles. As America's largest soaring land bird, the condor is an easy target for unsportsmanlike hunters.

ENDANGERED BIRDS

- Hawaiian Dark-rumped Petrel
- Nene (Hawaiian Goose)
- Aleutian Canada Goose
- Tule White-fronted Goose
- Laysan Duck
- Hawaiian Duck (Koloa)
- Mexican Duck
- California Condor
- Florida Everglade Kite (Snail Kite)
- Hawaiian Hawk (Io)
- Southern Bald Eagle
- Attwater's Greater Prairie Chicken
- Masked Bobwhite
- Whooping Crane
- Yuma Clapper Rail
- Hawaiian Common Gallinule
- Eskimo Curlew
- Puerto Rican Parrot
- American Ivory-billed Woodpecker
- Hawaiian Crow (Alala)
- Small Kauai Thrush (Puaiohi)
- Nihoa Millerbird
- Kauai Oo (Oo Aa)
- Crested Honey-creeper (Akohekohe)
- Akiapolaau
- Kauai Akialoa
- Kauai Nukupuu
- Laysan Finchbill (Laysan Finch)
- Nihoa Finchbill (Nihoa Finch)
- Ou
- Palila
- Maui Parrotbill
- Bachman's Warbler
- Kirtland's Warbler
- Dusky Seaside Sparrow
- Cape Sable Sparrow

Attwater's Prairie Chicken

Frederick Kent Truslow — © National Geographic Society

Shaggy reminders of man's past . . . prove that rare species can survive.

There were millions of buffalo in the United States when the white man began his westward trek. They fell by the millions in a ruthless slaughter. When only 1,000 remained, they were brought under Federal and state protection and now number about 20,000; in fact, carefully controlled hunting sometimes is necessary to keep herds within the grazing capacity of refuges. This is part of a herd at South Dakota's Custer State Park.

ENDANGERED MAMMALS

Indiana Bat
Delmarva Peninsula Fox Squirrel
Blue Whale
Humpback Whale
Atlantic Right Whale
Pacific Right Whale
Timber Wolf
Red Wolf
San Joaquin Kit Fox
Grizzly Bear
Black-footed Ferret
Florida Panther
Guadalupe Fur Seal
Caribbean Monk Seal
Florida Manatee or Sea Cow
Key Deer
Columbia White-tailed Deer
Sonoran Pronghorn

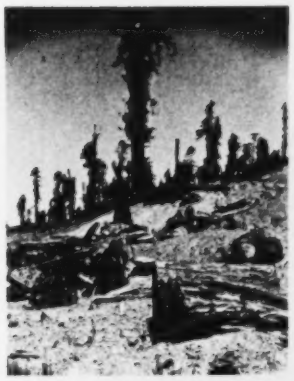
The Red Wolf . . . few remain.

California Bighorn . . . seldom seen.

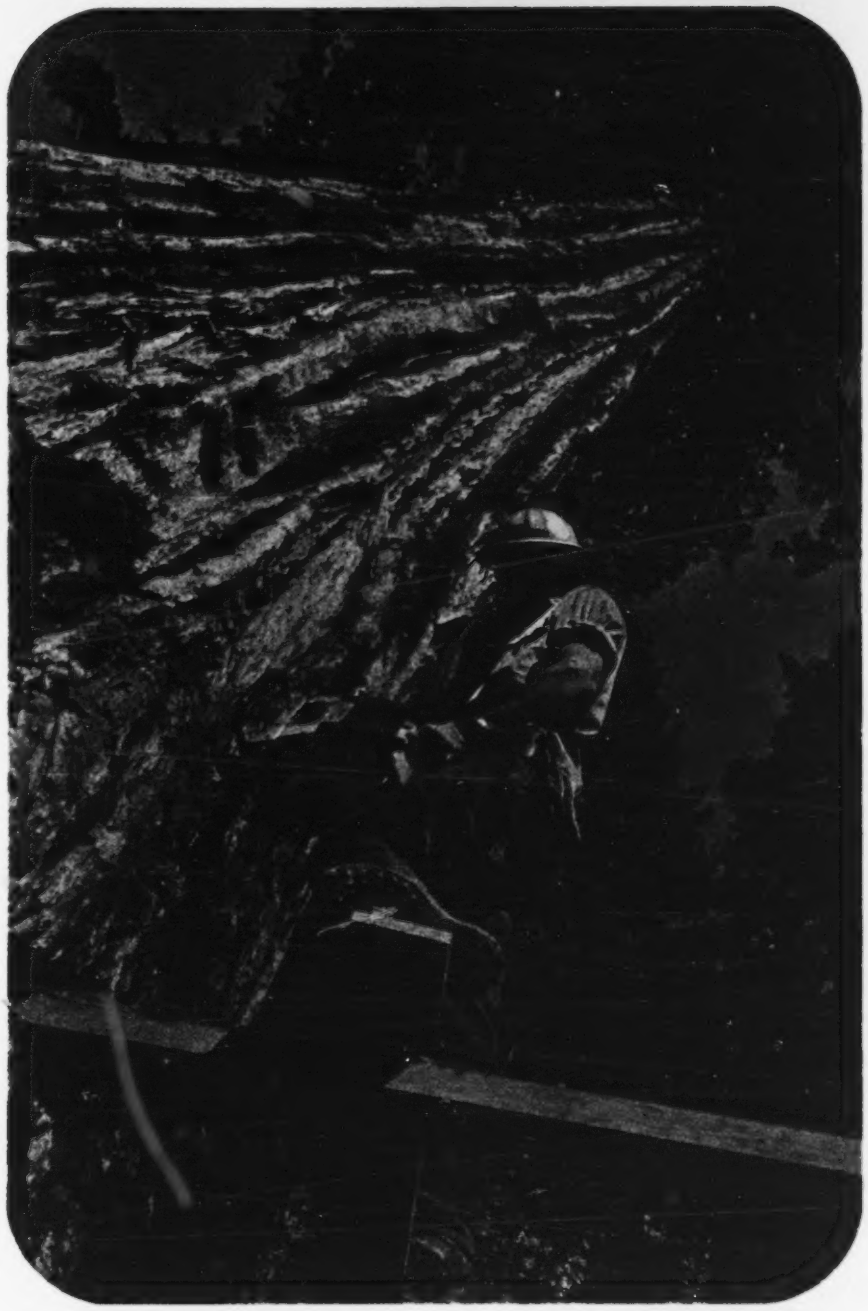
Mountain Lion . . . still survives.

Rapho-Guillumette — © National Geographic Society

These timeless Redwood giants disappear from the face of the



The Land of the Great Redwoods in California is one of great contrasts: Conservation at its best; lumbering at its worst.



James P. Blair — © National Geographic Society

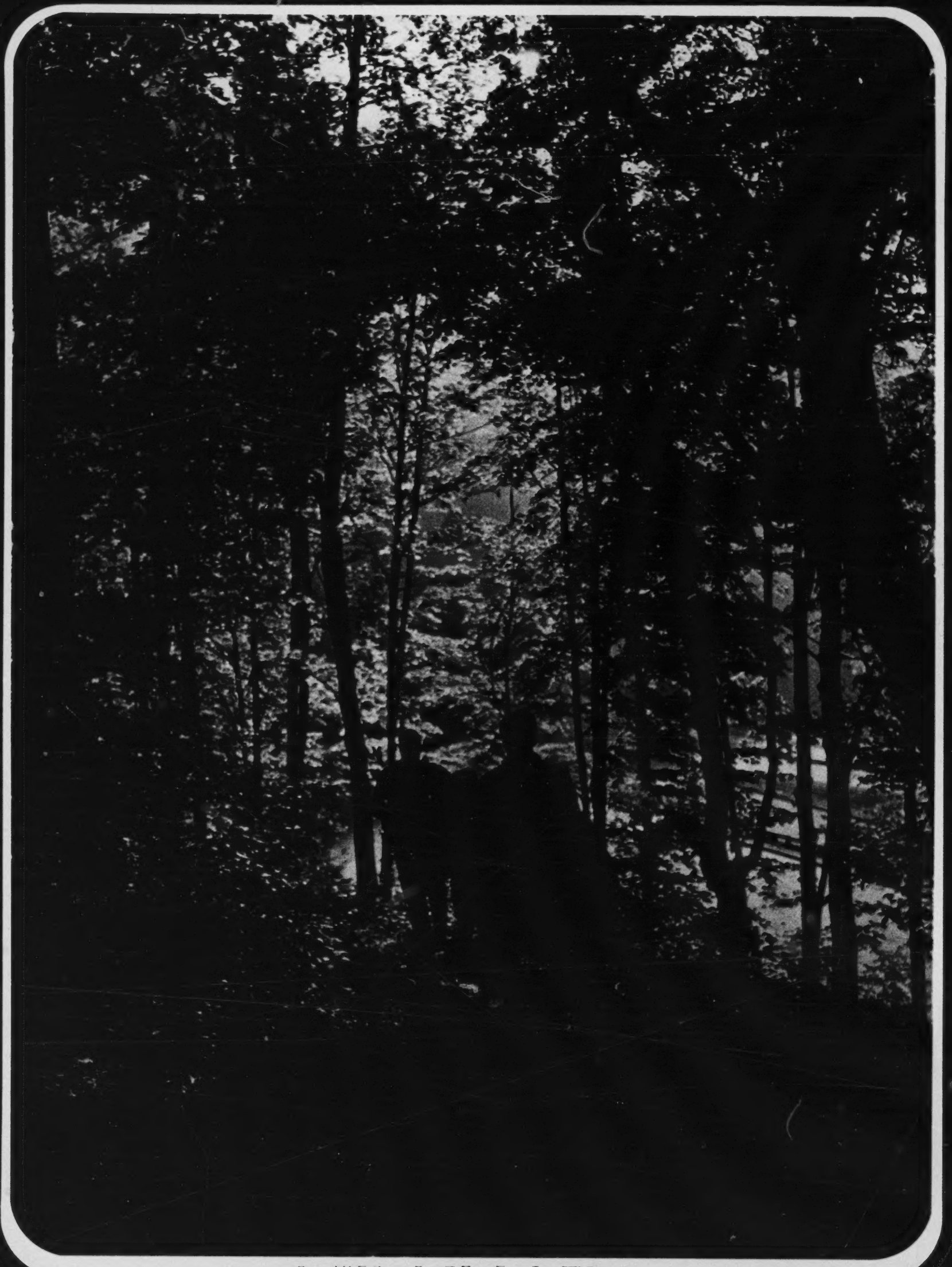
land in the name of progress and profit . . .

. . . . with the march of civilization, these remarkable redwood groves, which came down to us from the original face of nature, are diminishing and gravely endangered.

Senator Thomas H. Kuchel, California

James P. Blair — © National Geographic Society

. . . gone too . . . are many millions of acres of . . . solitude,



Howard Valentine — Harvest Magazine — Campbell Soup Co.

peace, and quiet beauty! Much can still be saved!

In broadest terms, the Bureau's objective is to assure that all Americans have an opportunity to enjoy the out-of-doors, in all its rich diversity, as a daily as well as holiday experience.

Congress and the Administration recognized the constantly increasing needs of the American people for outdoor recreation by enacting the Land and Water Conservation Fund Act of 1965.

The year ended June 30, 1966, marked the first full year of this program. Through fiscal year 1967, Congress appropriated $251 million to this promising program. Of the total, $160 million was for assistance to the States and $86 million was for acquisition of recreation lands and waters by the National Park Service, the Forest Service, and the Bureau of Sport Fisheries and Wildlife.

Benefits of this program flow to the people of all 50 States, the Commonwealth of Puerto Rico, the District of Columbia, Guam, American Samoa, and the Virgin Islands. Grants on a 50-50 matching basis are made to the States and, through them, to cities, towns, and counties to assist in planning, acquiring, and developing new areas and upgrading existing ones.

Although the grants-to-States program only began in January 1965, nearly all the States have submitted projects for assistance. By mid-1966, help on 975 projects had been requested. In its first 18 months, the program aided in acquiring 50,000 acres of land and more than 400 acres of water for general public recreation.

Major uses of these acquisitions will include hunting and fishing (27 percent), water sports (18 percent), field sports (14 percent), picnicking (13 percent), and camping (12 percent). Most new acquisitions receiving Federal help are within 1 to 2 hours' driving time from urban population centers.

The 132 development projects for which grants had been approved by June 30, 1966, included large multiple-purpose metropolitan parks, boat launching facilities, ski lifts, campgrounds and ball fields, golf courses, tennis courts, swimming pools, biking and hiking trails, water impoundments, and ice skating rinks. Approximately 77 percent of the funds had been used for State projects and 23 percent for projects sponsored by cities, counties, and other local units of government.

Urbanized areas are showing an increasing interest in the program. Most individual projects have required relatively small amounts of Federal assistance, with 49 percent requiring less than $25,000.

The Land and Water Conservation Fund program serves not only to stimulate State action in outdoor recreation, thus lessening the need for direct Federal assistance, but also as a stimulant to private and nonprofit sectors.

Five percent of the States' share of the Land and Water Conservation Fund is withheld from apportionment and placed in a contingency reserve for use by the Secretary of the Interior to assist projects of outstanding recreation value that might otherwise be lost for this use.

Money from the contingency reserve already has stimulated State action on two projects of national significance. Early in 1966 Secretary Udall drew on the contingency reserve to help the State of Nevada obtain a sorely needed 12,157-acre State park on the shore of beautiful Lake Tahoe. Nevada matched a $2 million Federal grant ($1.5 million from the contingency fund plus $500,000 from its regular apportionment) and added a substantial donation from a private foundation as a part of the $6 million needed to purchase the park area. Tahoe's superb scenic assets seriously threatened by pollution and rapid development, now have a chance.

The second possible "national save" is the long-sought Allagash Wilderness Waterway in Maine. Under an agreement between Maine and the Federal Government, Secretary Udall set aside $1.5 million from the contingency reserve subject to approval by Maine voters of a matching $1.5 million for the project. If established, the Allagash Wilderness Waterway would keep unspoiled one of the most beautiful scenic riverways in the East.

As a result of the Land and Water Conservation Fund Act, all Federal acquisition of lands and waters for outdoor recreation now is coordinated through the Bureau of Outdoor Recreation. The program directs Federal expenditures to the most pressing needs, avoids conflicting or overlapping actions, and correlates Federal acquisition with that of State and local governments.

President Johnson and Secretary Udall have stressed the importance of locating recreation areas and facilities to help meet the needs of large urban populations. The national recreation area represents a new concept—that population be the guiding factor in establishing recreation areas. In line with this concept, Congress authorized the 39,630-acre Assateague Island National Seashore in Maryland and Virginia; the 30,000-acre Cape Lookout National Seashore south of Cape Hatteras off the coast of North Carolina; the 70,500-acre Delaware Water Gap National Recreation Area in Pennsylvania and New Jersey; the Spruce Knob-Seneca Rocks National Recreation Area in West Virginia; and the Whiskeytown-Shasta-Trinity National Recreation Area in California.

Congress appropriated $41.7 million from the Land and Water Conservation Fund for acquiring Federal recreation areas in fiscal 1967. This compares with $5.5 million appropriated in 1965 and $39.2 million in 1966. The 1967 money will provide for additional land and water for the National Park Service ($23.5 million), the Forest Service ($18.1 million), and the Bureau of Sport Fisheries and Wildlife ($172,500).

Most of the fund appropriated for Federal acquisition will be used to buy property in the five newly authorized areas. The remainder will be used to expand national parks and national forests, to obtain areas suitable for preserving certain species of threatened wildlife, and for recreation purposes at a wildlife refuge.

The slogan of Operation Golden Eagle, "Use, Enjoy, and Help Expand Your Great American Outdoorland," is part of the new program to sell annual $7 entrance permits to Federal recreation areas. The permits are known as "Golden Passports" and every penny received from these sales is earmarked for the Land and Water Conservation Fund. A Golden Passport admits the holder and all occupants of his automobile to all designated Federal recreation areas for an entire year. One-day entrance charges may be paid at all such areas by persons who do not wish to purchase $7 annual permits. Thirty-day permits are available in some locations.

The Golden Passport is based on the concept that the direct beneficiary of a Government service or product should pay at least part of the cost for such outlay. Fees are charged only where there has been a substantial Federal investment in

recreation. Great expanses of Federal lands in many national forests, portions of the public domain lands, areas around reservoirs and elsewhere remain available for recreation use without permits.

Keenly aware of the importance of quality in our environment, President Johnson on May 4, 1966, issued an Executive order establishing the President's Council on Recreation and Natural Beauty and a Citizens Advisory Committee on Recreation and Natural Beauty. The Council was instructed to review recreation and natural beauty plans and programs of Federal agencies and to make policy recommendations to the President. It also was authorized to conduct studies in related fields and to assist in coordinating these programs.

The President's Council on Recreation and Natural Beauty is composed of the Secretaries of Agriculture, Commerce, Defense, Interior, Housing and Urban Development, and Health, Education and Welfare; the Chairman of the Federal Power Commission; the Chairman of the Board of Directors of the Tennessee Valley Authority; and the Administrator of General Services Administration. The Secretary of Commerce was designated the Council's first Chairman and will serve a 2-year term that ends in 1968. The Director of the Bureau of Outdoor Recreation is Executive Director of the Council.

The Citizens' Advisory Committee is to advise both the President and the Council on matters relating to outdoor recreation and beautification of cities and countryside, and correlation of natural beauty and outdoor recreation activities of Federal organizations, and local, State, and private outdoor recreation and natural beauty activities. The Committee has 11 members, selected by the President.

Another new conservation dimension is the Nationwide Outdoor Recreation Plan, which the Bureau of Outdoor Recreation is preparing and which is intended to guide development of sound public policy in outdoor recreation. It will help assure the variety of recreation opportunities desired by the American people.

The plan will consider outdoor recreation in the broadest sense, including natural beauty and quality of environment. It will encompass urban and rural, public and private programs; it will guide the outdoor recreation programs of other Federal agencies which are required by the Bureau's Organic Act to carry out their "responsibilities in general conformance with the nationwide plan."

The plan also will provide a framework for regional, State, local, and private outdoor recreation programs by developing recommendations for these various programs to meet current and future outdoor recreation needs.

The Nationwide Outdoor Recreation Plan will project America's outdoor recreation demands to the years 1980 and 2000, with recommendations for measures to assure that these needs are met. The Bureau of Outdoor Recreation is to submit the nationwide plan to the President and the Congress by 1968, and to update it periodically thereafter.

The first nationwide inventory of recreation provided by the private sector has been completed. It provides new and valuable information concerning the contribution of private endeavor in helping meet outdoor recreation needs. Studies of demand, including a Bureau of the Census study of public preferences for outdoor recreation activities, are underway.

Still another new dimension in conservation was enactment of the Federal Water Projects Recreation Act. This recognizes that outdoor recreation and fish and wildlife shall be treated as equal with other purposes in developing Federal water resources projects. Recreation can no longer be considered a "byproduct" of Federal water development projects.

BOR is studying the recreation potential of selected river basins and water resource projects of the Corps of Engineers and the Bureau of Reclamation, to assure that outdoor recreation and protection of natural beauty are adequately considered in project planning.

Another new concept is the setting aside in perpetuity of some of the Nation's wild rivers in their primitive or natural state.

A joint Interior-Agriculture study to determine the need for a national system of wild or scenic rivers has been completed. It considered more than 700 rivers, made preliminary investigation of about 60, and conducted detailed examination of more than a dozen.

In January 1966, the Senate passed a wild rivers bill that designated seven rivers—the Rogue in Oregon, the Salmon and Middle Fork of the Clearwater in Idaho, the Rio Grande in New Mexico, the Eleven Point in Missouri, and the Shenandoah and the Cacapon in West Virginia—for immediate inclusion as National Wild Rivers. The bill also would establish a national wild rivers system, with provision to include additional rivers.

Proposed for possible later inclusion are portions of the Skagit in Washington; the Upper Missouri in Montana; the Green in Wyoming; the Niobrara in Nebraska; the Buffalo in Tennessee; the Suwannee in Georgia and Florida; the Wolf in Wisconsin; the Little Miami and Little Beaver in Ohio; the Susquehanna and the Delaware in Pennsylvania and New York; the West Branch of the Susquehanna, Allegheny, Pine Creek, and the Clarion in Pennsylvania; the Youghiogheny in Maryland and Pennsylvania; and the Upper Hudson in New York.

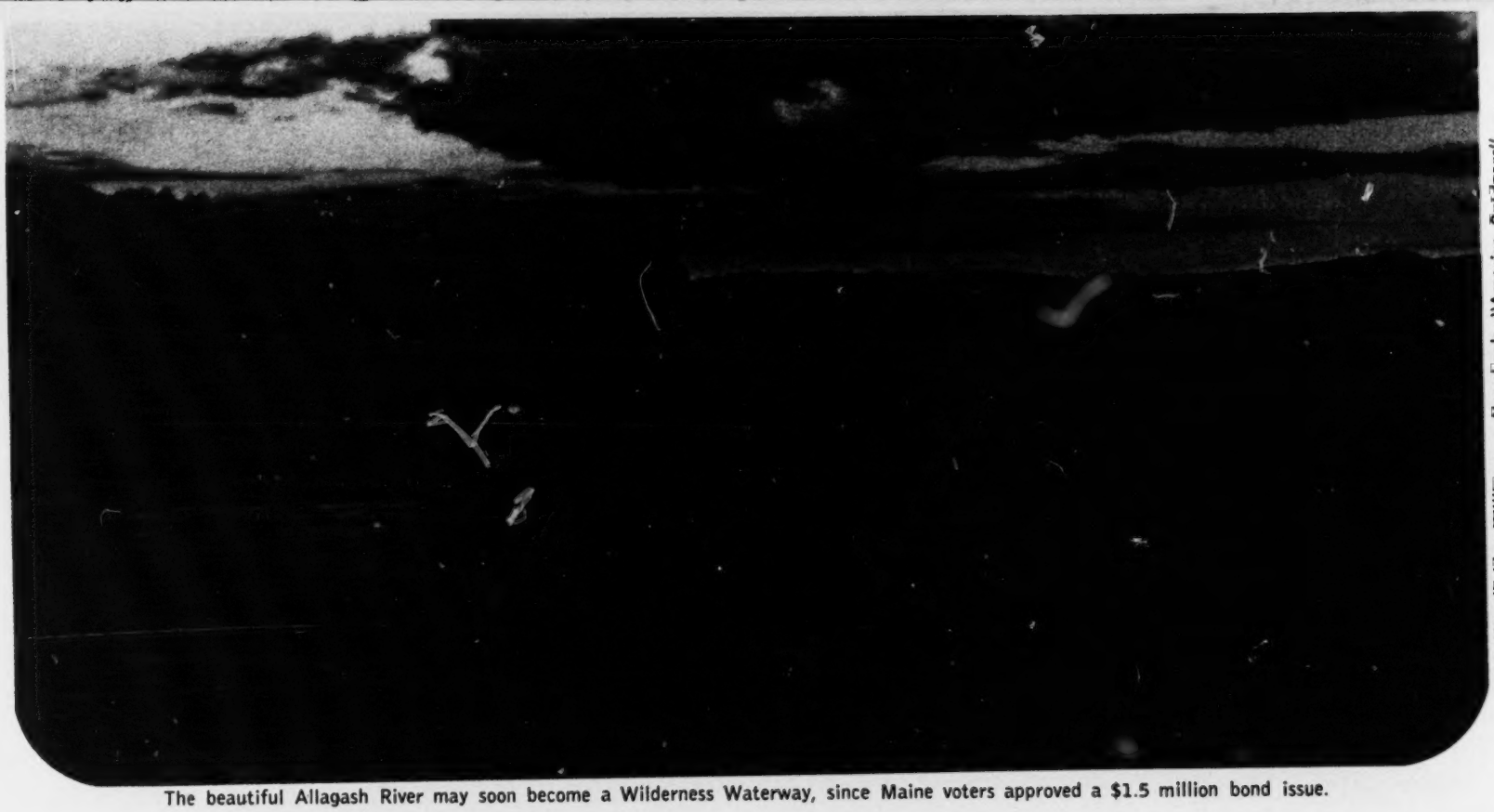
Based on plans prepared by an interagency steering committee, the Bureau made a nationwide trails study in cooperation with Federal land management agencies, States, and private interests.

The study evaluated several major "trunk trails", such as the famous Appalachian Trail from Maine to Georgia, and analyzed ways in which trail programs on Federal, State, or private lands could be bolstered to meet present and future needs. Special attention was devoted to trail needs in and near metropolitan areas.

The study culminated in submittal to Congress in March 1966, of a bill to establish a nationwide system of trails. It would have four general classes of trails: National Scenic Trails, Federal Park and Forest Trails, State Park and Forest Trails, and Metropolitan Trails. In support of the proposed program, a comprehensive report was prepared.

One of the immediate bonuses from the study was Secretary Udall's action in making money available from the contingency reserve of the Land and Water Conservation Fund for trails in 12 urban areas. For a relatively small amount of money, significant trail additions will be made to metropolitan areas in 12 different States.

The urban trail projects range from a walking and nature trail in a forest area near Manhattan to a plank trail through a marshy, wildlife area in Seattle; from improvement of a



M. Woodbridge Williams — Newsbook, "America Outdoors" — The National Observer — Dow Jones & Co., Inc.

The beautiful Allagash River may soon become a Wilderness Waterway, since Maine voters approved a $1.5 million bond issue.

All three of these spectacularly scenic areas have been recently studied and found worthy of National Park status. Bitterroot Mountains (left) are part of Lewis and Clark National Historic Trail, in Idaho. Ross Lake (center) is in proposed North Cascades National Park in Washington State. Mount Stuart Range (right) is part of Enchantment Wilderness Area, recommended in the North Cascades Report.

140-mile network of bicycle and horseback riding trails near Phoenix to a specially constructed bikeway on county parkland through the heart of Arlington, Va., across the Potomac from the Nation's Capital.

These 12 metropolitan area trails may well stimulate interest in the legislation submitted to Congress to establish a nationwide system of trails. They could become pioneer components of such a system.

Responding to the President's Message on Natural Beauty, the Departments of the Interior and Defense began an inventory to determine the recreation and conservation potential of military lands, totaling some 28 million acres. The inventory provides facts that will permit Federal, State, and local agencies to act quickly to acquire for park and recreation purposes appropriate lands declared surplus by the military. A total of 132 military installations containing some 580,000 acres has been studied for conservation and recreation potential. Of these, 35 containing 225,000 acres probably will be used for recreation and other conservation purposes. Thirty-one other installations, containing 109,400 acres with conservation and recreation potential, are scheduled for further study.

A 2½-year Interior-Agriculture study to determine how 6.3 million acres of national park and national forest lands in the North Cascade Mountains of Washington could best serve the public interest was completed and a report issued in 1966.

The report recommended establishment of 4 new wilderness areas totaling 720,000 acres, enlargement of the Glacier Peak Wilderness Area, better coordination of management between Mt. Rainier National Park and surrounding national forest land, a system of scenic roads and trails, and designation of a part of the Skagit River as a wild river. It also recommended that steps be taken to make available for commercial use about 1.5 billion board feet of sawtimber.

Concerning management of the area north of the Cascade Pass, members differed as to whether the area should be designated as a national recreation area.

In the fall of 1965, the Bureau of Outdoor Recreation submitted to the Lewis and Clark Trail Commission BOR's recommendations regarding historic, wildlife, and other recreation resources along the Lewis and Clark Trail route from St. Louis to the Pacific Ocean.

National concern that the natural beauty of the mighty Hudson River be preserved led to a study of the Hudson under leadership of the Bureau of Outdoor Recreation and auspices of the Recreation Advisory Council. The Bureau's report recommends several measures to preserve the river's natural beauty, provide public access to the river, and enhance its great recreation potential.

Bureau of Mines

The new dimension to traditional concepts of conservation poses for the Nation's mineral industries challenges both monumental and complex.

In an America that is awakening to the need for restoring and preserving environmental quality and for maintaining a proper ecological balance, the extraction and processing of essential minerals and fuels has to be done within a framework that is increasingly restrictive. It must be done, moreover, when national requirements for mineral raw materials are at the highest point in history and still accelerating. And, making the task even more difficult, is the fact that the Nation's wants and needs must be satisfied from a limited store of resources that is steadily diminishing both in richness and accessibility.

These major challenges are complicated and intensified by the shortage of skilled engineering manpower in nearly every phase of industrial activity involved in mineral extraction, processing, and utilization. The outlook for engineering manpower for the future is even gloomier.

As the only Federal agency with an explicit mandate for promoting mineral conservation through research and development, the Bureau of Mines works with industry and educational institutions towards meeting the challenges of today and tomorrow. During fiscal 1966, the Bureau pushed forward its most promising approaches to mineral-associated problems in the pollution of air, water, and land resources. It also continued, through research and development, to enlarge science's understanding of the natural forces—hostile and friendly—that must be faced in the mining and treatment of minerals, and to improve engineering's ability to work within the limits those forces prescribe. New emphasis was placed on development of techniques to yield more reliable economic forecasts of mineral supply and demand.

In all its activities the Bureau sought to achieve the most effective possible use of its scientific and engineering capabilities and to complement them wherever feasible with those of other organizations—Federal, State, and private. For example, it worked frequently throughout the year with its sister agency in the Department, the Geological Survey. Here the talents of both agencies were combined on projects ranging from definitive inventories of the mineral values of public lands considered for inclusion in the wilderness system to a new major effort aimed at increasing the domestic availability of gold, platinum, silver, and other heavy metals that are in short supply.

The Bureau, the Water Pollution Control Administration, the Bureau of Sport Fisheries and Wildlife, and the Geological Survey also continued to cooperate during the year in developing effective methods for controlling the acid mine water that pollutes fresh water sources in many coal mining areas of Appalachia.

Carrying out its traditional policy of working closely with industry in research and development programs that are directed to the attainment of national goals, the Bureau began several new joint investigations in such fields as air-pollution abatement, undersea mining, and advanced metallurgical technology. Additional progress also was made in several long-standing programs of this kind. In all, 43 cooperative-research agreements with industry were in effect during the year.

The Bureau's efforts to stretch as far as possible the limited supply of mineral-engineering manpower received an important legislative assist. The Solid Waste Disposal Act, signed as part of the Clean Air Act by President Johnson late in 1965, gave to the Bureau its first, though limited, authority to award grants as well as to make contracts for research, development, and similar activities. Secretary Udall, seeking to tap as much as possible of the Nation's technical talent in this new assault on a major menace to environmental quality, issued an appeal for constructive proposals to be funded under the Act's provisions. By year's end, the Bureau had carefully reviewed and evaluated the initial group of responses and was prepared to award the first contract and the first grant for solid-waste-disposal research. These projects and others like them to follow will enlist the skills, knowledge, and creative abilities of scientists and engineers in industry, in universities, and in private research organizations in many parts of the United States. They will strengthen our national capability in environmental-quality engineering, helping insure that we do not become saddled with the distinction, as one speaker put it, of "being the first people to put a man on the moon while standing knee-deep in garbage."

Meanwhile, still with an eye to future needs for trained technologists, the Bureau began expanding its research-fellowship program. At year's end, cooperative agreements for such fellowships—providing opportunities for undergraduate and graduate students to work part-time in Bureau laboratories and research centers—were in effect at more than a score of educational institutions throughout the country.

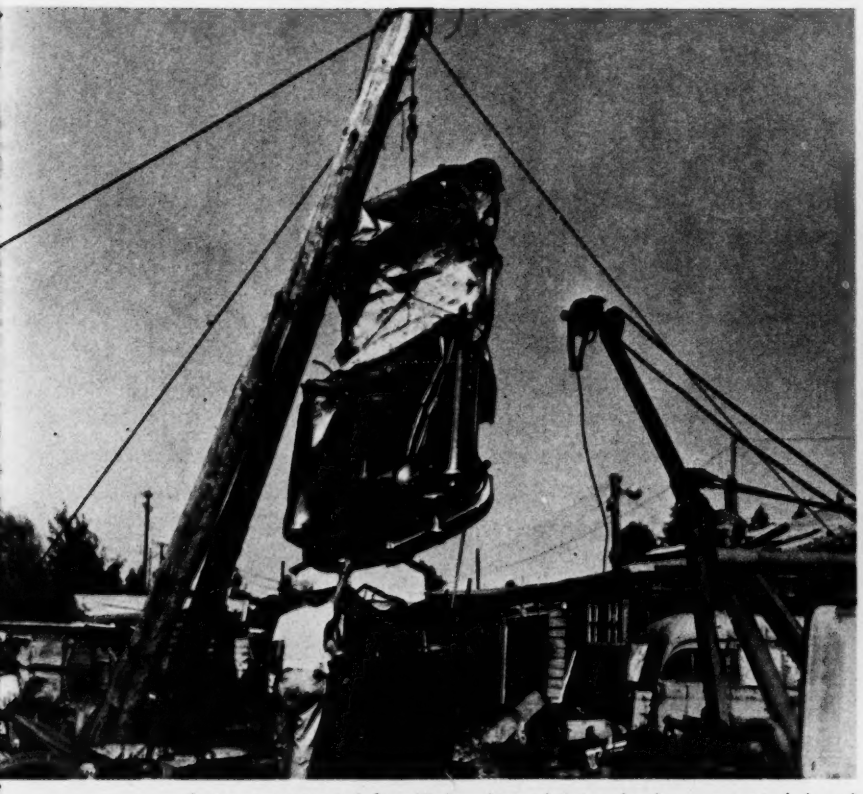
Thus, working cooperatively or on its own, the Bureau of Mines in fiscal 1966 contributed significantly to the needs and the aims of a society that has begun to look at itself more objectively than ever before and has set out determinedly to achieve greatness in its truest sense. The following is a brief review of the year's major developments.

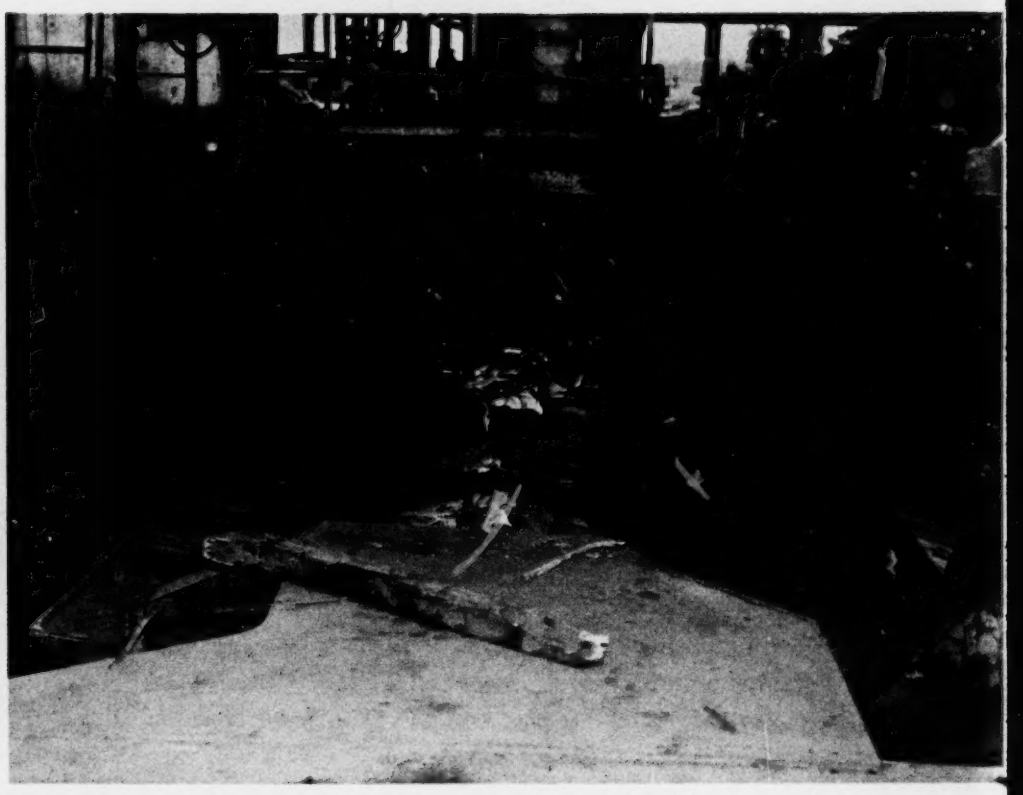
Not only did the Bureau move quickly toward utilizing its contracting and research-grant authority under the Solid Waste Disposal Act, but it substantially advanced existing programs directed to the same goal of minimizing waste and pollution.

Progress was made in developing a Bureau process which promises an economic means for utilizing scrap from discarded autos and plentiful low-grade iron ore that has thus far remained untapped. The Bureau awarded a contract for engineering design studies to precede construction of a plant on Minnesota's iron range, where the process will be demonstrated on a commercial scale.

Another approach to cleaning up the Nation's proliferating "auto graveyards" will be tested in a new pilot plant in Albany, Oreg. The method, worked out at a Bureau research center in the West, would make auto hulls more readily usable in blast furnaces by selectively melting out the copper, aluminum, zinc, and other nonferrous metals that act as contaminants in steelmaking.

Bureau waste-disposal research aims, wherever possible, at eliminating the various forms of mineral pollution by finding ways to use the resource values they still contain. Experiments during the year with one of the processes aimed





Auto carcass at left will be sheared into chunks, compacted (as shown at right) and fed into rotating kiln to roast out unwanted metals.

at putting scrap autos back to work, indicated that this method is equally effective in converting discarded stoves, refrigerators, and similar appliances into a suitable feed for blast furnaces. The Bureau also began seeking economic methods for recovering the metal values from municipal wastes. The city dumps of our Nation are estimated to contain some 5 million tons of iron—mainly in the form of "tin" cans—and anywhere from one-half to 1 million tons of nonferrous metals. The iron content of municipal-incinerator residues is largely ignored today, even though it is as high as some iron ore now mined commercially. An economic process for recovering iron from such residues could enlarge substantially the domestic resource base for this important metal. Since most municipal wastes now end up as landfill, recovery of the metals they contain would significantly extend the life of expensive sites now used for refuse disposal.

An essential step toward eliminating the land pollution that accompanies surface mining was taken by the Bureau with completion of the first phase in a nationwide study of the reclamation and restoration problems posed by such operations. Authorized by the Appalachian Regional Development Act of 1965, this study is being conducted by the Bureau in cooperation with other Federal, State, and local organizations.

The halfway mark in this investigation was reached with completion of a report presenting findings for the Appalachian region, which was sent to the Appalachian Regional Commission as required by the 1965 act. The report, on past surface and strip mining in the region and its effects on streams, fish and wildlife, and urban development, noted, among other things, a need for a minimum reclamation effort which would cost an estimated $250 million.

The Appalachian Act also provides for reclaiming and rehabilitating surface-mined areas on public lands in the region and, on a State-Federal cooperative basis, for projects to control: (1) Subsidence of the surface overlying mined-out coal seams; and (2) fires in abandoned underground coal workings.

During the year the Secretary of the Interior approved three subsidence-control and seven mine-fire-control projects in Pennsylvania—the first undertakings of this kind to be proposed by a State under the Appalachian Act's provisions. The Federal Government's share of these 10 initial projects, which is 75 percent of their total cost, exceeds $13 million. However, the subsidence projects alone will protect approximately 2,000 homes and numerous churches, schools, and other public and private buildings which have a total estimated value of about $50 million. Many additional millions of dollars worth of property and, more important, the lives and health of hundreds of thousands of people will be safeguarded by the fire-control projects. Collectively, the 10 projects are expected to provide up to 1,300 man-years of employment in this economically depressed region.

With public attention focused as never before on the twin menaces of polluted air and polluted water, the Bureau of Mines intensified and expanded its antipollution efforts. The programs, all concerned with minerals-related pollution, are advancing knowledge in such areas as the combustion of fossil fuels, automotive exhaust-gas emissions, and the pollutants generated in mining and processing minerals.

Under a cooperative research project with the U.S. Public Health Service, preparations were made during the year for pilot-plant testing of a Bureau process for removing sulfur dioxide, a major pollutant, from industrial stack gases. At the same time the Bureau worked on this problem from the other end by seeking improved methods for removing sulfur from coal before it is burned in industrial furnaces. Nuclear techniques and material were studied as agents for rapid analysis of sulfur in coal.

Bureau research on automotive exhaust gases gained additional impetus with the launching of a new scientific study supported by the petroleum industry, aimed at relating the components of auto exhaust gases to the physical and chemical

properties of various gasolines and gasoline additives. Meanwhile, related Bureau research sought a better understanding of reactions that produce exhaust-gas pollutants, and the relationships between exhaust-gas composition and such variables as engine design and operation and fuel-air mixtures. Another new project, aimed at tracking down and identifying certain diesel-exhaust pollutants through the kinds and intensities of odors they produce, was started.

Experiments progressed in recovering pollutants generated in producing steel, copper, and other base metals. The already heavy attack on the pollution caused by acid mine water was intensified. Here the Bureau is cooperating with the Water Pollution Control Administration, the Geological Survey, and the Bureau of Sport Fisheries and Wildlife in four projects to demonstrate methods for controlling acid mine-water pollution. Three of the projects are in Pennsylvania and one is in West Virginia.

Through a broad program of research in mining, metallurgy, and fuels technology the Bureau continued to seek additional ways for enlarging the Nation's mineral-resource base. Sometimes alone, but more and more frequently under cooperative agreements with industry, Bureau scientists and engineers worked to develop a new technology, one that wrests from our dwindling deposits of rich and easily accessible minerals the material wealth essential for leisurely enjoyment of a quality environment.

The groundwork was laid for a new approach to what has emerged as a primary requisite in mining research, a mine-systems engineering program. Such a program—covering every aspect of the mining operation from the breaking of rock to the support of underground tunnels and openings, the transport of ore and waste, and the control of the working environment—recognizes that mining is a series of intricate and interrelated operations which must still be flexible enough to adapt to widely varying conditions. An important aspect of this systems approach is the development of techniques to exploit leaner and leaner ores under more difficult conditions while minimizing damage to other values of the land. Systems engineering has been developed by the Bureau to assure that the varied components of its research program are properly related to the broad spectrum of mining operations and problems.

In line with this long-range systems approach, the Bureau continued to probe for a better understanding of the fundamental forces that hold rock together and make it react in different ways to different stresses. It also proceeded, in cooperation with a large copper company, with a project to determine the maximum safe slope angle in open-pit mining, where a single degree one way or the other can mean the difference between recovering substantial tonnages of valuable ore and leaving them useless in the ground.

Another cooperative research venture, aimed at supplementing mineral resources of the land with minerals from under the sea, was strengthened when a third industrial partner joined the Bureau in a program that also is receiving support from the Atomic Energy Commission and the State of California. The Department of Defense has supplied the Bureau with three research vessels; two already are in service and a third was being refitted for undersea studies.

Additional progress was made in Bureau research on using mining wastes to provide support for mine workings and for mined-out areas underground. With vast urban complexes encroaching ever more rapidly on the once-remote areas where mines and quarries operate, Pennsylvania's adoption of a blasting code was of particular significance. This code is based on knowledge gained through Bureau research on how blast vibrations capable of damaging surface structures travel through the earth.

A literally shining example of the treasures that may lie hidden in waste materials is the scarce and precious metal, silver, which in highly pure form is contained in used photographic film-fixer solution. The Bureau has developed a technique using inexpensive steel wool to recover this silver. Work continued on the process, for which the Bureau sees promising commercial possibilities in a small-business operation similar to a water-softening service. Such an application would curb the waste of a valuable metal that is in short supply and also would mean increased economies for small photoprocessing firms and for amateur and professional photographers who each year throw millions of ounces of silver down the drain because they lack a practical and convenient means for its recovery.

Another, and much larger potential source of needed minerals became apparent during the year with completion of successful experiments in recovering magnesium and potash from brines of Utah's Great Salt Lake. A preliminary evaluation of the Bureau's process, called ion-exchange desulfation, indicates it has strong potential for commercial application in recovering millions of tons of these two minerals—and perhaps others, such as lithium—from the lake's brine solutions. This promising approach to a technological problem which many have tried for years to solve, may also provide a way to improve the economics of large-scale saline-water conversion.

Outstandingly successful among the Bureau's cooperative ventures with industry was the research program being conducted with iron and steel producers to improve blast-furnace technology. On the strength of this program's past accomplishments, which have increased furnace efficiency, it was mutually agreed to extend the joint investigative effort for a fifth full year.

The first stage of a multimillion dollar program of experimentation being carried out with the financial backing of six major oil companies was completed at the Anvil Points, Colo., oil-shale installation formerly operated by the Bureau of Mines. These initial experiments, made possible under a leasing agreement with the Department of the Interior, included successful trials with two small, Bureau-designed oil-shale retorts and limited research on the mining and crushing of shale. Aimed at perfecting the technology for commercial production of petroleumlike materials from the extensive oil-shale deposits of Colorado, Utah, and Wyoming, this research and development project is now well into its second stage. In coming months experiments will be performed with a much larger shale retort, also a product of Bureau research. Development of mining and crushing methods will be intensified. Industry has enlarged the sum originally budgeted for the program by $1.5 million.

Meanwhile, the Bureau proceeded with other research to determine whether it is technically feasible to fracture and retort oil-shale underground, thereby avoiding costs of mining

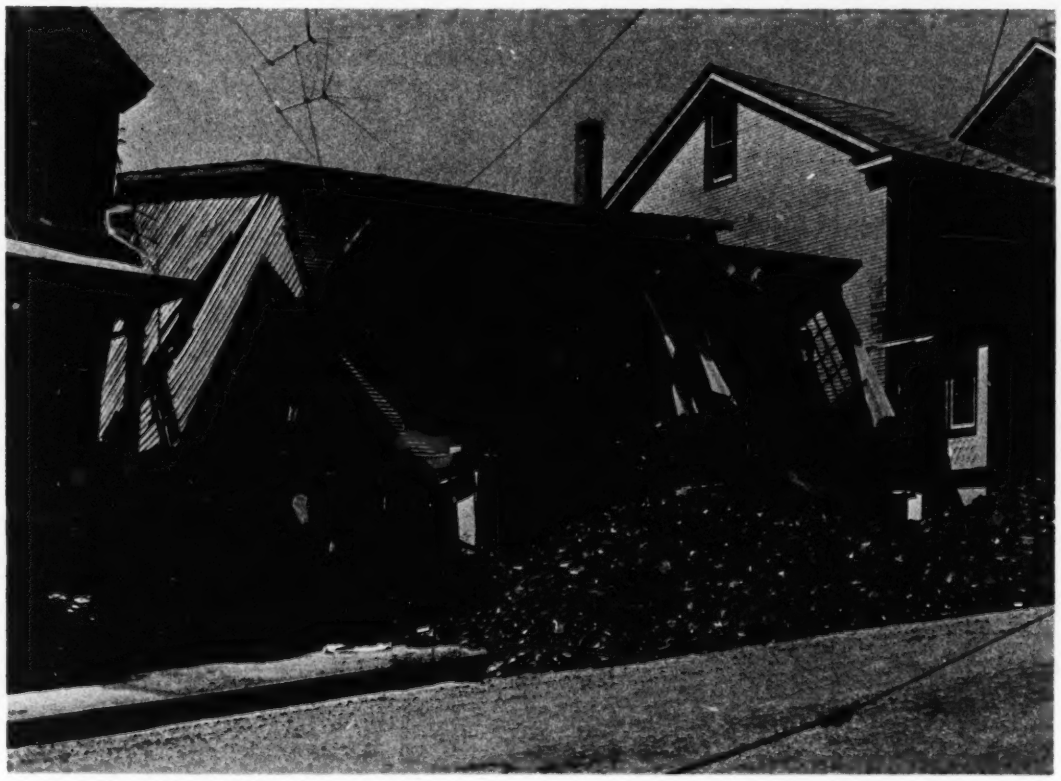
. . . so many acres of scarred lands are waiting to be transformed into needed playlands, forests, and agricultural areas.

Congressman John P. Saylor, Pennsylvania

Billy Davis — Louisville Courier Journal — Audubon Magazine

A mountain is ravaged, a valley shattered near London, Kentucky. This barbaric land desecration is called strip mining.

The kind of mine subsidence that capsized this house is being attacked successfully in cooperative State-Federal efforts, expanded under the Appalachian Regional Development Program.



it and disposing of the spent shale after retorting. One promising approach uses high-voltage electricity to burn pathways in a shale deposit. Conceivably, these could be filled with a chemical explosive which, when detonated, would fracture the deposit enough so air could be injected underground to sustain the combustion required for retorting.

Still another possibility, being considered jointly by the Bureau and the AEC, is the use of a nuclear explosive in deep, thick deposits to create a large subsurface "chimney" of crushed shale, which also might be retorted in place. Coreholes drilled during the year in the search for a site that would be suitable for a nuclear-explosive experiment yielded new information on the extent of the western shale formations. As a result, the estimate that these immense deposits contain 2 trillion tons of crude-oil equivalent may be revised upward. The Bureau also experimented with above-ground equipment, retorting 10-ton batches of shale that had been crushed to sizes approximating those that could be expected to be produced deep within the earth by a nuclear explosion.

Progress in Bureau research on the use of bituminous coal as a raw material for a widely used variety of carbon black attracted industrial interest. Experiments yielded a substance with properties nearly identical to a commercial product called "thermal black," which is used to improve the quality of consumer items ranging from tire sidewalls to floor tile.

This development, offering the possibility of a new use for the Nation's abundant coal resources, was an unexpected by-product of the coal-research program. Bureau scientists were reacting coal with ammonia in efforts to make hydrogen cyanide (a staple of the chemical industry) when they discovered that a carbon black was being produced as well, in potentially economic yields. Until now, all commercial carbon black—including the thermal variety—has been obtained from petroleum or natural gas. The market for the thermal grade alone is approximately 100,000 tons annually, and the Bureau is continuing its research to determine whether other types of carbon black also can be made from coal.

The Bureau also moved forward with research and development designed to achieve more efficient and economic use of domestic coal and lignite reserves in generating electric power, in supplying coke for metallurgical use, and, in providing liquid fuels and chemicals to supplement those now obtained from petroleum. The Government's cooperative efforts with industry to stimulate sales of American coal abroad have helped create an umprecedented firmness in the coal-export market which had held steady for 3 years at the level of 50 million tons annually.

The Bureau studied the potential for economic use of mineral resources in several of the Nation's major river basins, and helped provide the background for directing the progress of urgent Federal programs such as those now underway under the Appalachian Regional Development Act, the Clean Air and Solid Waste Disposal Acts, and the Federal Water Pollution Control Act.

The Bureau's helium-conservation program took a new direction with the signing of a contract under which the Bureau will store, over the next 5 years, up to 300 million cubic feet of helium owned by a private company. The company is one of several from which the Bureau buys helium for conservation under long-term purchase agreements. In this instance, however, the Bureau will be paid (about $30,000 the first year) for storing a quantity of the lightweight gas above that which the Bureau agreed to purchase annually. The Government's helium-conservation objective will be achieved though in a distinctly different way, because the storage operation will save for future use helium that would have been wasted if left in the fuel gases which carry it.

Highlighting the Bureau's assignment of promoting safe and healthful working conditions and practices in mining were two events: President Johnson signed the so-called "small mines act," extending to some 50,000 of the Nation's coal miners the same kind of protection against disasters that is provided by Federal inspection of large coal mines—those employing more than 14 men underground. Less than 2 weeks later the Bureau announced its successful development of the world's first machine-mounted methane monitor, designed to guard against the deadly menace of gas explosions in underground coal mines.

In these ways, and in many others, the Bureau of Mines worked to advance the cause of mineral conservation in concert with the more realistic view of conservation that the United States and its people have come to hold.

Office of the Science Adviser

Emphasis of the Office of the Science Adviser was on planning for new or increased scientific efforts to meet changing natural resources problems. Man's modification and alteration of natural, wild environments led to the planning of new studies in ecology. Information will be sought through research and surveys to improve the decisionmaking processes of resource conservation and management.

A new plan for collecting and making available scientific information on water was developed in cooperation with the Department's Office of Water Resources Research. This system will be handled by the Water Resources Scientific Information Center being established in Washington, D.C., and Denver, Colo.

In the field of water resources the Science Adviser, together with members of the Bureau of Reclamation, took part in studies aimed at augmenting precipitation and water supplies through weather modification. Extensive coordination of water pollution control research responsibilities was carried out when the Water Pollution Control Administration was transferred to the Department in May 1966.

As the Department's member of the Federal Council for Science and Technology, the Science Adviser gave leadership to programs in solid earth sciences, including earthquake research and forecasting, and also to oceanography, and water resources research.

Legislation was proposed by the Science Adviser to broaden the authority of the Secretary to accomplish research by contracts or grants to nongovernment organizations.

Bureau of Land Management

Realizing that these continue as critical times in the history of the public lands, the Bureau of Land Management in 1966 began welding a new partnership with the people, inviting their assistance in deciding the best future use of these areas.

"These are your lands," long a BLM slogan, assumed a partnership-with-people emphasis that tended to give the Bureau a new dimension for conservation of resources on the 460-million-acre public domain, one-fifth the Nation's land area. This working arrangement between BLM and the people made striking gains toward a higher level of effective multiple-use management of these "forgotten lands."

Methods were established for bringing the public into BLM's decisionmaking processes, opening the door to better understanding of land-use relationships. This relationship found major expression in the testing and developing of procedures to classify public lands for retention or disposal under the new classification and multiple-use law. By approaches such as local hearings and by thorough discussion of all proposals, BLM sought wide public participation in reaching decisions.

Another major new piece of legislation, the Public Sale Act of 1964, has spurred citizen interest. It requires local government participation in zoning and in planning orderly development. BLM started a program to assist local governments in undertaking comprehensive land-use planning. Here again, orderly growth and best uses of the land are encouraged.

The new approach, threaded through all BLM programs, gives new impetus to the Bureau's efforts to serve the public interest in conservation better.

The Classification and Multiple Use Act provides a system for determining which public lands are to be disposed of and which kept in Federal ownership. Those retained are to be managed for multiple use and sustained yield of resources "in the combination that will best meet the present and future needs of the American people." While the law expires June 30, 1969, the U.S. Senate made clear that its purpose is "to provide a positive means for evaluation and possible modification . . . after a reasonable period of application."

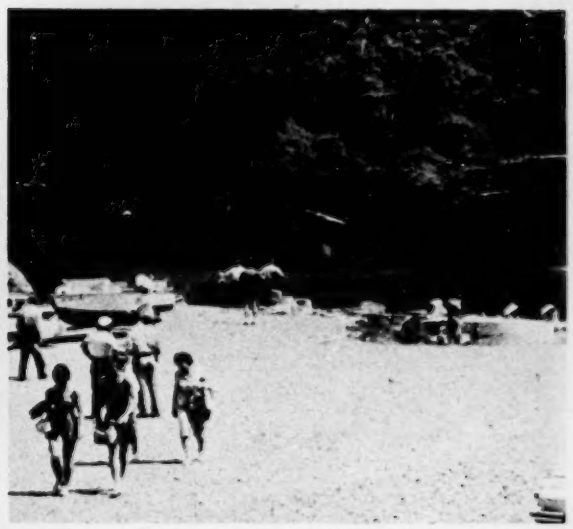
In establishing decisionmaking processes for carrying out the Classification and Multiple Use Act, BLM first identified the need for local public participation—by land users, local governments, and others concerned with the land. In so doing, BLM followed the cardinal principle that coordinated planning is essential for successful land-use management.

Public participation was organized around an analysis of the public lands completed during the year. The lands were subdivided into geographic areas, called planning units. Facts about each unit are presented to the public as the first step in determining the proper classification. The process was tested in 18 counties of the West during the year. First experience indicated the approach was sound and the public was ready to participate earnestly in the decisionmaking process.

The first proposed classification under the new system was published in the *Federal Register* June 3, 1966, and involved 600,000 acres in Valley County, Mont. The Valley County Planning Advisory Group, appointed by the Valley County Commissioners, conducted 25 public meetings throughout the area to inform the public fully and to seek local views and recommendations. BLM believes this approach will help insure that public lands meet their share of future resource needs of the Nation.

Preservation of public values, including open space and natural beauty, is a basic element in the rules under which public lands are being classified. The Bureau engaged the

Forester measures Oregon Ponderosa pine. BLM sells over 1.5 billion board feet yearly from 41 million acres of public land.



Wildlife (antelope) and recreation (Loon Lake, Oregon) are primary BLM concerns.

Oil reserves in public land shale deposits run to billions of barrels, await orderly recovery.

Maps helped participants at hearings to determine retention or disposal of public lands

Three Sisters dominate Valley of the Goblins, sold to Utah by BLM.

University of Utah to conduct an "open space" study, to help BLM develop guidelines for all management and disposal activities.

Preservation of natural beauty and proper use of open space are being incorporated into all BLM management programs under principles set forth in the President's 1965 message on the "Natural Beauty of Our Country." High professional standards using modern concepts of land-use planning now govern small-tract subdivisions. Leases must contain specific development standards in harmony with the locale and natural landscape. Many sales and leases under the Recreation and Public Purposes Act require an assurance that open areas for scenic enjoyment and outdoor recreation will be maintained.

BLM programs also involve control of advertising displays and trespasses. Unsightly signboards and unauthorized "improvements" were removed as quickly as possible, especially along scenic highways. In the first six months of 1966, the Bureau terminated about one-fourth of such trespasses on public lands. Protective withdrawals were made from areas with outstanding scenic and recreation values.

Transition from custodianship to action programs is part of the new dimension by which BLM is putting the public lands to work in the public interest. Each parcel will be expected to sustain those values for which it is particularly adapted. Under the classification and multiple use law, BLM first considers the needs of all users of these lands and then seeks to provide the best combination of uses.

The resource products from these lands are identified with water quality and prevention of downstream damage, livestock forage, timber production, aesthetic values, wildlife-oriented recreation (such as fishing and hunting), and general recreation.

BLM's work in soil and vegetation control extends from northwestern Alaska tundra to the forested slopes of western Oregon, from the Western Plains and Rocky Mountains to the creosote bush of southern Arizona. These public lands are interspersed with lands owned by States, communities, companies, and private citizens. The success of public land management depends on progressive, cooperative programs.

Procedures for planning and carrying out action programs by field offices have been developed by BLM, the Soil Conservation Service, and the National Association of Soil and Water Conservation Districts. BLM has entered into agreements with nearly 100 soil and water conservation districts, and more agreements are being developed. BLM also is working with participants in small watershed programs administered by the Department of Agriculture.

Room to roam is the greatest national appeal of the public lands. Thus, outdoor recreation is a major management responsibility of the Bureau.

Working with the Department's Bureau of Outdoor Recreation, BLM has inventoried potential recreation areas on the 460 million acres of public domain lands, to aid in preparation of a nationwide recreation plan. BLM has identified more than 1,100 areas on the public lands as having recreation potential. They range from small parcels of 100 acres or less to extensive areas containing several thousand acres. Included are hunter camps in Idaho and Wyoming, pristine mountain meadows in Washington and Oregon, rushing stream areas in Alaska, countless scenic corridors and roadside park sites, shores of clearwater lakes and reservoirs in California and Utah, camping and fishing sites in Colorado and Montana, and dry campsite opportunities in the fascinating deserts of Nevada, Arizona, and New Mexico.

While BLM's emerging role in outdoor recreation embodies the concept of room to roam, it simultaneously provides for preservation and other sound use of open space. New concepts govern management responsibilities. Questions are being asked in every management decision: Does this area warrant its inclusion in the Nation's system of national recreation areas? Is this one a future wilderness area? Is this a wild river? Can these public lands offer anything toward a national system of trails? What about trails for the bicycling public? And how best can we tell the story of the public land and its resources?

Even the arid lands of southern California are providing some exotic new recreational opportunities for skydivers, glider riders, dunes jockeys, and do-it-yourself helicopter pilots. Irrigation and reclamation reservoirs offer additional water- and land-based recreation.

BLM's recreation orientation is a recent development, so only about 2,000 family camping units in 136 developed recreation sites exist on the public lands. This number was not nearly enough to accommodate adequately the more than 30 million man-days of annual use. However, with the recreation inventory now complete and the potential identified, BLM is proceeding with orderly planning along the following lines:

Establish priorities for planning, development, and management to meet present and future demands;

Identify and protect scenic corridors and roadside strips, reservations, and other areas;

Classify and protect existing and potential recreation areas; emphasize development on areas that have national or regional significance or offer water-based recreation opportunities;

Preserve natural beauty and provide only appropriate recreation facilities in harmony with the surroundings;

Provide information, access, boundary identification, ownership maps, and directional signs;

Reserve areas with special values, such as wilderness and wild rivers;

Interpret the history, archeology, geology, and ecology for better understanding and appreciation;

Manage and improve wildlife habitat in coordination with State and Federal agencies;

Coordinate with other units of government to fulfill the nationwide recreation plan; assist them in using the Recreation and Public Purposes Act;

Provide sanitation facilities and good maintenance; and

Reach management agreements with intermingled owners to facilitate recreation use of the public lands.

A great potential exists for more sport fishing and hunting opportunities on the public lands. Accordingly, BLM is placing additional emphasis on increasing fish and wildlife populations, through improving the habitats.

Under proper management, the public domain is capable of producing more wildlife that any other Federal lands in the West. Almost a third of the public domain has been identified as important to wildlife. One example is the 175,000 miles of

© National Geographic Society

Alaska Brown Bear, land's largest flesh eater, may stand nine feet high and weigh up to 1,600 pounds.

streams that flow across these lands, offering some of the world's finest trout fishing.

BLM maintains an up-to-date inventory of wildlife habitat areas, analyzes effects of grazing animals on the habitats, develops food and cover in critical areas, and provides access to public lands to hunters and fishermen.

States regulate the harvest of wildlife, but BLM, working closely with wildlife agencies and sportsmen's groups, is responsible for habitat management.

A mighty repair job is required if the public land administered by BLM is to make a realistic contribution to this Nation. More than 6 million acres are described as "frail watershed." Badly eroded, barren, and abused—first by man and later by wind and water—they are a major source of stream pollution. An additional 44 million acres continue to deteriorate toward the "frail land" category. Another 125 million acres are eroding at moderate rates, the speed of degeneration depending upon intensity of rainstorms or snowmelt.

Unfortunately, much water flowing from BLM-managed watersheds contains excessive sediments, salinity, and silt. Recent analysis shows a startling picture of annual decline in the condition of these watersheds.

The sediment carried from the 40 percent of the upper Colorado Basin administered by BLM in 1 year alone would cover the 69-square-mile District of Columbia to a depth of 19 inches. This sediment is deposited in Lake Powell, formed by Glen Canyon Dam.

For many years, BLM has carried out watershed protection programs. Some isolated successes have been counted, but on the whole the program has been inadequate to cope with the total problem. Achievements include reduced soil losses and improved flood control in the Willow Creek project in Montana; the Rio Puerco frail watershed rehabilitation program in New Mexico; the soil stabilization and range development programs near Vale, Oreg., and Burley, Idaho; rehabilitation of the Humbolt River Watershed near Elko, Nev., after a 300,000-acre wildfire; the Picture Gallery Gulch chaparral conversion work for water yield and wildlife habitat near Sonora, Calif.; and the erosion and water-control works in Centennial Valley, Ariz.

In earlier years, Bureau effort was oriented toward range improvement. Recently, a range-development and conservation program has evolved. Gradually, proper use of forage, land treatment, and structural programs have been related to erosion and water control on a site-by-site basis. The Bureau now requires formal management of small watersheds as such.

Land and water resources are inseparable, and watershed improvement programs are basic to the Nation's overall water resources development.

BLM's future watershed management, in accordance with this concept, will be based on a combination of three approaches:

1. Harvest-type uses, such as domestic livestock grazing and timber cutting, will be locally adapted to insure that vegetation, soil, and moisture requirements are not out of balance with the erosion hazard. Effective watershed management on most of the western ranges continues to be handicapped by lack of specific local information about protective plant and soil requirements and about acceptable limits of grazing use.

2. Treatment will be started to stabilize the soil and increase its water-holding capacity. Denuded sites will be planted with perennial grasses and desirable wildlife shrubs. Contour furrowing, terracing, deep tillage, soil ripping, brush control, and small check dams will help store moisture for vegetation and hydrologic balance.

3. Waterflow originating on and passing through lands administered by BLM will be subjected to controls. Such measures include dams, waterspreading, and similar steps where gullying and deterioration of the soil-moisture balance are critical.

Program direction is bound to change as knowledge in-

creases. Until now, the incentive for conservation has been production control rather than hydrologic control. Rangeland watersheds eventually must be managed as such, for the intimate relationship between land and water means that the method of managing land affects the runoff and quality of waterflow.

Today livestock is a healthy industry and grazing is still an important use of the public lands in the West. But land managers and ranchers are looking to the range for many additional uses, among them wildlife enhancement, scenery, and recreation. Multiple use is the revitalizing principle of BLM's new range management program.

Intensive management principles applied to each grazing allotment permit land use in harmony with watershed values, natural beauty, recreation, wildlife, timber resources, and other qualities..

BLM's new range management program aims at effective "on the ground" management of the forage resource to promote soil stability and good watershed conditions. Less effort will be directed toward recordkeeping and the legal aspects of range management; more will go into improving condition of the land. In accomplishing these goals, the integration of grazing with other uses will be sought.

To evaluate program effectiveness, new range studies have been developed. Changes in grazing use will depend on changing vegetative conditions and necessary management adjustments will be made.

Rest-rotation grazing has supplied new answers to some old problems. Under rest-rotation, stock is moved from area to area, controlling the vegetation, protecting the watershed, and assuring more grass in the long run. Allotments demonstrating this technique of management have been established in all BLM districts.

Cooperation by ranchers using public lands is the vital force in these new grazing management plans. Mutual cooperation under which the rancher manages his livestock in accordance with multiple-use plans is brightening the conservation scene on the public rangelands.

A forest means many things to many people. To the lumberman it is a source of building material. To the family on vacation it is a place for relaxation and enjoyment To the highway traveler, it may be a scenic vista. To the hunter it is the home of wildlife. To everyone the forest is a special place; all want something special from it.

The public domain contains approximately 38.5 million acres of land on which timber is grown, managed, and harvested as a crop. But the public domain lands include 100 million acres of additional woodland on which grow the dwarf forests, such as juniper and pinon. These acres are important to soil stability and wildlife, they also yield Christmas trees and fenceposts. Management of all the public domain forest areas constitutes a major conservation challenge.

Demand for timber products in the United States is expected to increase by 80 percent by the year 2000. This means that timberland management must be practiced on a high level of efficiency. BLM is doing its part by salvaging old-growth trees which have been damaged by fire, diseases, and insects; and by devising new methods for harvest of dead timber in young stands.

In cooperation with the Forest Service, BLM is carrying out a special management project, now 4 years old, on BLM-managed timberlands in Tillamook County, Oreg. This pilot study is testing new concepts in young growth management. Experts seek economic evaluations from studies of thinning practices, logging road standards and logging methods. Annual harvest of timber from the project might increase as much as 40 percent as a result of intensified management.

Increasing needs of the American people require close analysis of the role of BLM forest lands. Through proper management a forest can produce wood products, recreational sites, improved wildlife habitat, and increased water quantity without damage to quality. This is the new conservation of the forest lands. Some uses will not be developed to their individual optimum, but the combination eventually adopted will yield the largest net benefits for the most people.

America cannot afford to waste its forests. Old ideas must be banished to make room for management concepts that fit a changing society.

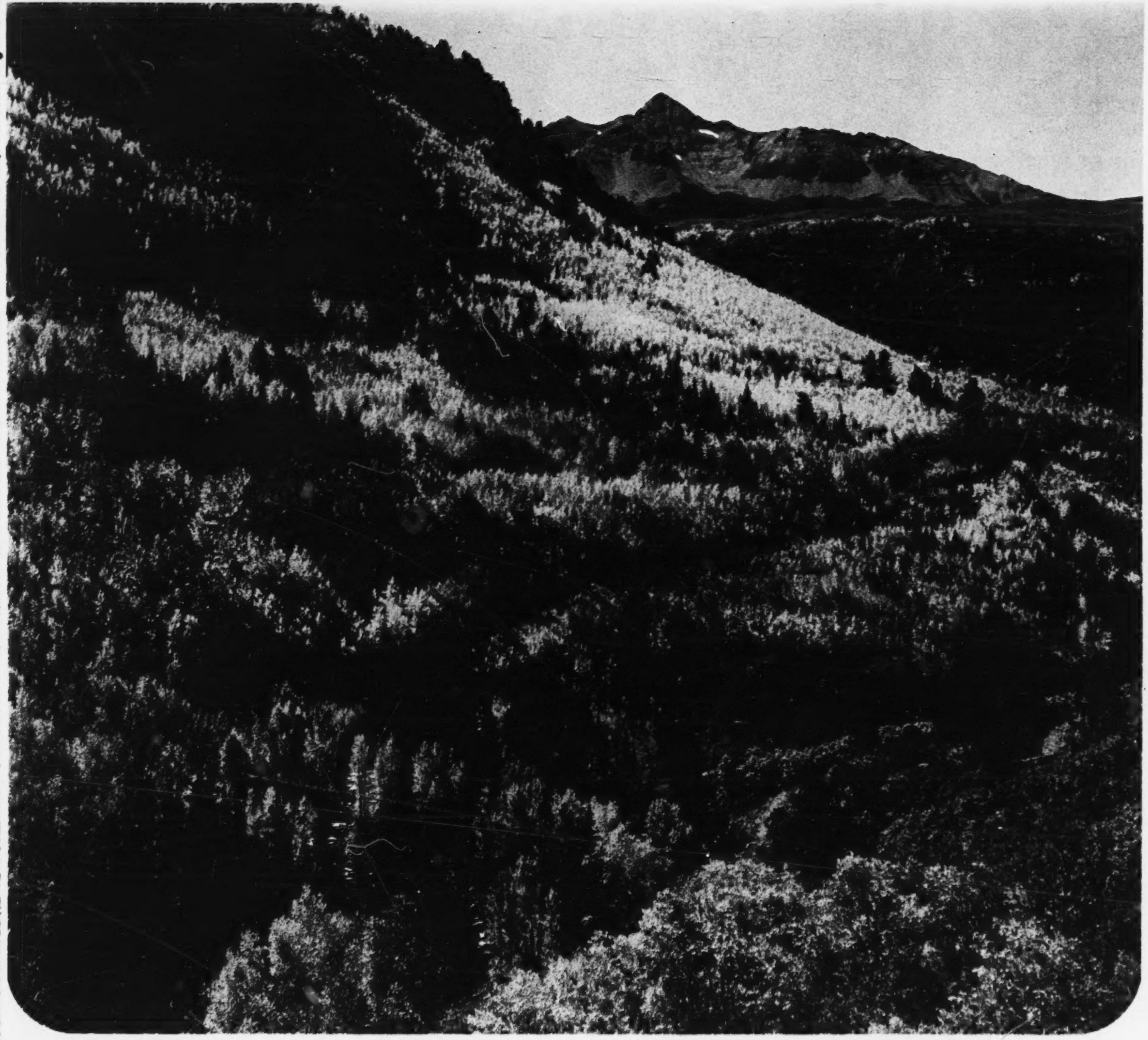
Prevention of man-caused forest fires continues as one of BLM's major forest management objectives. Protection of the forests and ranges from wildfire in fiscal 1966 set a record for success. While favorable weather and field conditions were factors, only 1,084 fires burned in BLM lands compared to an annual average of 1,225 fires over a 5-year period. A new low of 46,120 Federal acres were burned over in 1965. During the past 5 years, the average annual burn was nearly 200,000 acres.

BLM maintains and administers nearly 52,000 miles of roads. Underway in 1966 were 35 new road projects. The new or improved access to the public lands they provide will open additional opportunities for recreation. Although the expanding road system on the public land makes maintenance an increasing burden, it is BLM's plan to keep all existing and new roads in operation.

Access to public lands is receiving increasing attention from BLM. Cutoff from public use are millions of acres accessible only if roads into them are provided by adjoining landowners. BLM is working on this problem, but much remains to be done. By building multiple-purpose roads, either across private lands or around them, BLM has provided access to some of the public land.

One of this country's greatest undeveloped resources is oil shale. Deposits in Colorado, Wyoming, and Utah (Green River Basin) are estimated to contain a potential 600 billion barrels of oil, about twice the amount of the world's known recoverable petroleum reserves. This great energy source lies untapped because petroleum supplies have been plentiful and easier to extract.

Shale deposits do not yield oil as such, but marlstone which contains kerogen, an organic deposit from which "oil" is obtained through distillation. This oil can be processed to yield kerosene, gasoline, diesel fuel, and jet fuel. The deposits are mostly the remains of small plants which decomposed through millions of years. Formations vary in thickness and richness, but commercial interest centers on deposits which will yield at least 15 gallons of oil per ton. Many questions must be answered before the oil shale deposits on public lands are developed. Secretary Udall insists that public policy decisions about oil shale be made "in a goldfish bowl" of public understanding. Placing all



SHOSTAL — Jack Zehrt — Western Publishing Co.

With 41 million acres of commercial forest land to administer, BLM is cooperating with the Forest Service in a series of management studies. These golden aspens are marching across a mountainside in San Juan National Forest near Placerville, Colorado.

the issues before the public requires time, and the decisions to be made are too important and far-reaching for hasty judgment.

Surveying of public lands is a continuing job for BLM. Crews are continuously expanding and improving the survey system, using new equipment and techniques in the never-ending search for better and more economical means of land identification.

BLM surveying involves cooperation with local governments and others in selecting public lands for transfer. A major project in recent years has been the surveying of lands selected by the Alaska State government under the Statehood Act.

Regulations to protect better the surface of the public lands from mining and geophysical exploration scars were asked by the Bureau in 1966. The proposed regulations call for control of surface uses of areas under lease for coal and phosphate exploration and provide for licensing and followup inspections of seismographic and geophysical prospecting for oil and gas.

During the year, five Job Corps centers operated by BLM helped restore dignity and usefulness to young men while simultaneously protecting and restoring the Nation's other resources. Young men learned trades and skills that equipped them for productive lives while improving the condition of our environment.

Job Corps centers sponsored by BLM were operating at Tillamook and Fort Vannoy, Oreg.; Mountain Home, Idaho; Castle Valley, Utah; and Kingman, Ariz. One of the centers, Castle Valley, underwent a major expansion in 1966, going from a 100-man unit to a 200-man installation.

After the predictable period of trial and readjustment, the BLM's Job Corps program moved forward with a minimum of difficulty and corpsmen assigned to conservation tasks made important contributions to BLM's overall program.

National Park Service

The world has undergone drastic change since establishment of the National Park Service more than 50 years ago. Technologic advances have helped man achieve certain successes against natural forces. But these victories have been costly. Man has used up much of the natural environment—the environment that is just as natural to man as to the birds of the air and the beasts of the field. The cost has been appalling in the destruction of forests, the pollution of streams, the befouling of the air.

As one surveys the "progress," one factor remains constant—man has continued to call for more parks, quiet places of beauty where he may renew his strength, places of history where he may draw inspiration from his past.

When the National Park Service was born, the landscape of America was a picture of small farms, rural towns, and only a few crowded places. The Nation's political and economic philosophy was one of growth and expansion. The victories of technology have gravely distorted the relationship of man to the earth, plants, animals, and more recently, to the total environment. The serious problem man faces is how to use his power to manage his environment without destroying the values he hopes to preserve.

The very nature of the traditional conservation challenge has been fundamentally altered. Man now must create and restore areas close to large cities, where the masses of people now dwell. To meet the challenge of the new conservation, man must strike a reasonable balance between national growth and expansion on one hand, and recreation and the wilderness on the other. It is a challenge to all levels of government—Federal, State, and local. There is reason to question whether parks can continue to live and grow in response to the needs of the people, and still retain their capacity to provide enjoyment. From time to time parks have become worn out—victims of the demands of a growing population—and have been closed off for a period of rest and rejuvenation.

The paradoxical situation points up the challenge to the park movement and the critical decision facing park administrators. The age-old question, one that has confronted many movements in the past, is whether to maintain the status quo—to adhere to traditional concepts and rest on past laurels—or to search for a more responsive answer to man's needs in an era of change.

In seeking a balance planners must discard the idea that man is always and invariably an intruder in nature. He has changed the face of the earth greatly, sometimes wisely, sometimes in an absurd manner, not recognizing that he is as much a part of nature and the natural scene as a giant redwood or a deer or a whooping crane. All men are part of nature and all men will benefit to the degree they make themselves partners with nature.

Although most people now live in cities, they still long for the refreshing out-of-doors. With this in mind, the National Park Service no longer devotes most of its energies to developing huge natural parks in remote areas. The new conservation ethic demands that attention be given increasingly to the needs of the large urban population which cannot travel the breadth of the continent to enjoy nature.

This changed approach will require closer cooperation among Federal, State, and local park authorities, conservation groups, and private citizens. In many ways the National Park Service has been a leader in this movement. Until 1961, Congress required that all land to be used for park purposes be either donated by States or individuals or formed from public lands. The great National Parks of the past 50 years were created in this manner. Yellowstone and the Grand Canyon were public lands; the Great Smoky Mountains, Shenandoah, and Grand Teton National Parks were created largely through State and private land donations. Yosemite and Big Bend National Parks had their beginnings as State parks of California and Texas.

The National Park System of tomorrow must include outstanding examples of our natural scene now inadequately represented—marshlands, desert lands, grasslands, ocean environments, geological formations, and wildlife communities. Outstanding examples still exist, but they are becoming scarcer.

Among the Nation's highest priorites for action to protect irreplaceable natural resources is the creation of a Redwood National Park in northern California. Saving of these magnificent stands of coast redwoods is a question of "now or never." The proposed Redwood National Park in northern California has a long history of private conservation efforts. As far back as 1884, *The San Francisco Daily Chronicle* editorialized:

> **Soon the whole neighborhood will be cleared of growing timber. Already the fairest and largest trees have fallen before fire, axe, and saw. Those magnificent pillars, which form so strange a crown to the mountains when seen from San Francisco and the bay, are slowly disappearing.**

The first move to preserve some of the redwoods came in 1852, even before the move to set aside Yosemite Valley. It took the form of a joint resolution to the California State assembly, cited the rapidly increasing demand for redwood timber, and urged passage of a law to prohibit settlement and occupation of public lands on which redwoods grew. It proposed making such timberlands common property of the citizens of the State. The resolution was not adopted.

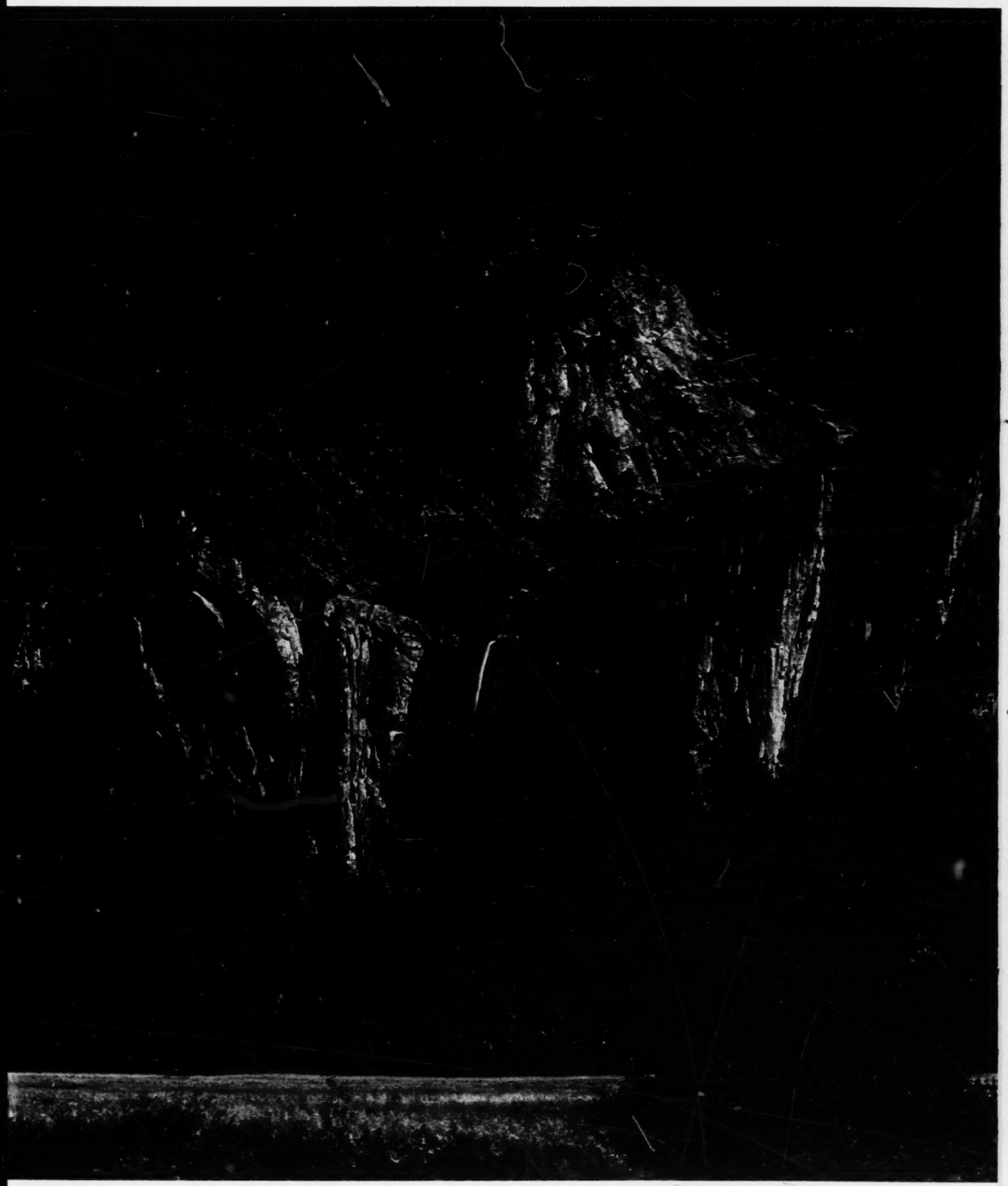
The first successful move came in 1902 with establishment of Big Basin Redwoods State Park—result of work done by the Sempervirens Club of San Jose, Calif. Muir Woods National Monument followed in 1908, a gift of William Kent to the Federal Government. These two initial actions were the work of private conservation interests—a fascinating point, for that has been part of the park development pattern ever since.

With formation of the Save-the-Redwoods League in 1918, direct land acquisition became an important factor in preserving the redwoods. The first unit of the Humbolt Redwoods State Park, containing 2,000 acres, was established in 1921 through League efforts. With the purchase of nearly 7,000 acres of Mill Creek redwoods by the League in 1939, another State Park was established. This park, later to be called Jedediah Smith, combined a dense outstanding forest of redwoods intermingled with other splendid trees and recreation attractions along the beautiful Smith River.

(Continued on page 111)

A COLOR ESSAY

A Parade of National Parks



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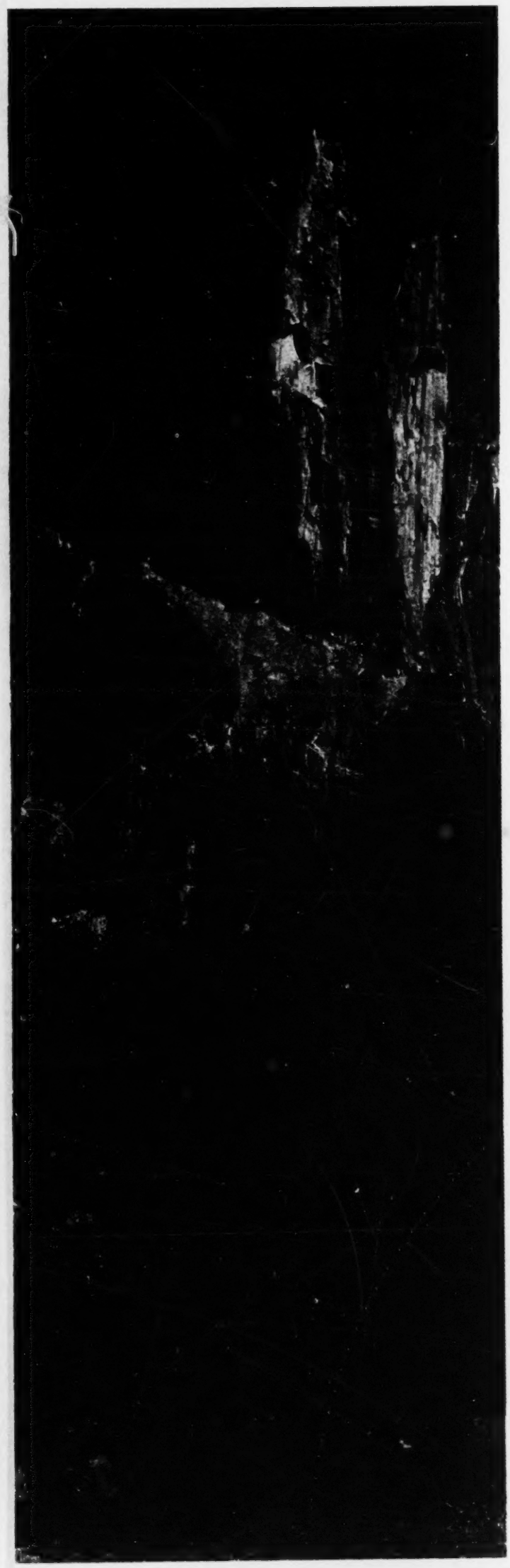


YOSEMITE
LOCATION: East-Central California
SIZE: 758,659 acres
ESTABLISHED: 1890

Beauty is its own excuse for being.

Emerson

What is a National Park? The beauty of YOSEMITE . . .

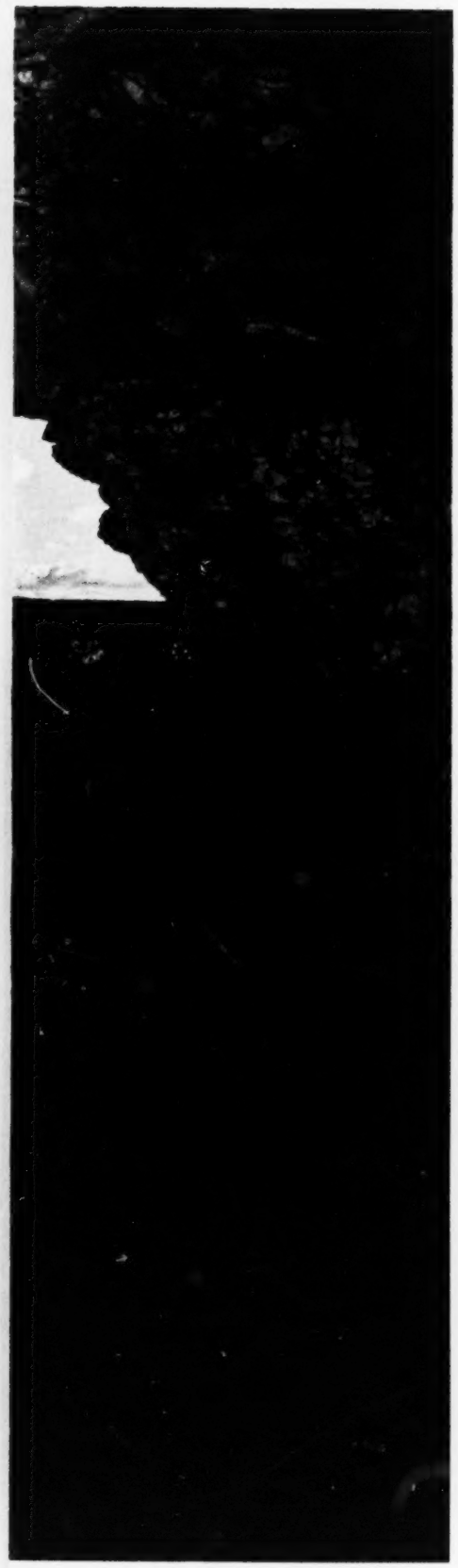
U.S. Travel Service — U.S. Dept. of Commerce

The natural wonders preserved for all Americans in . . .

There is a pleasure in the pathless woods,
There is a rapture on the lonely shore . . .

Lord Byron "Childe Harold"

GRAND CANYON
LOCATION: Northwestern Arizona
SIZE: 673,203 acres
ESTABLISHED: 1919

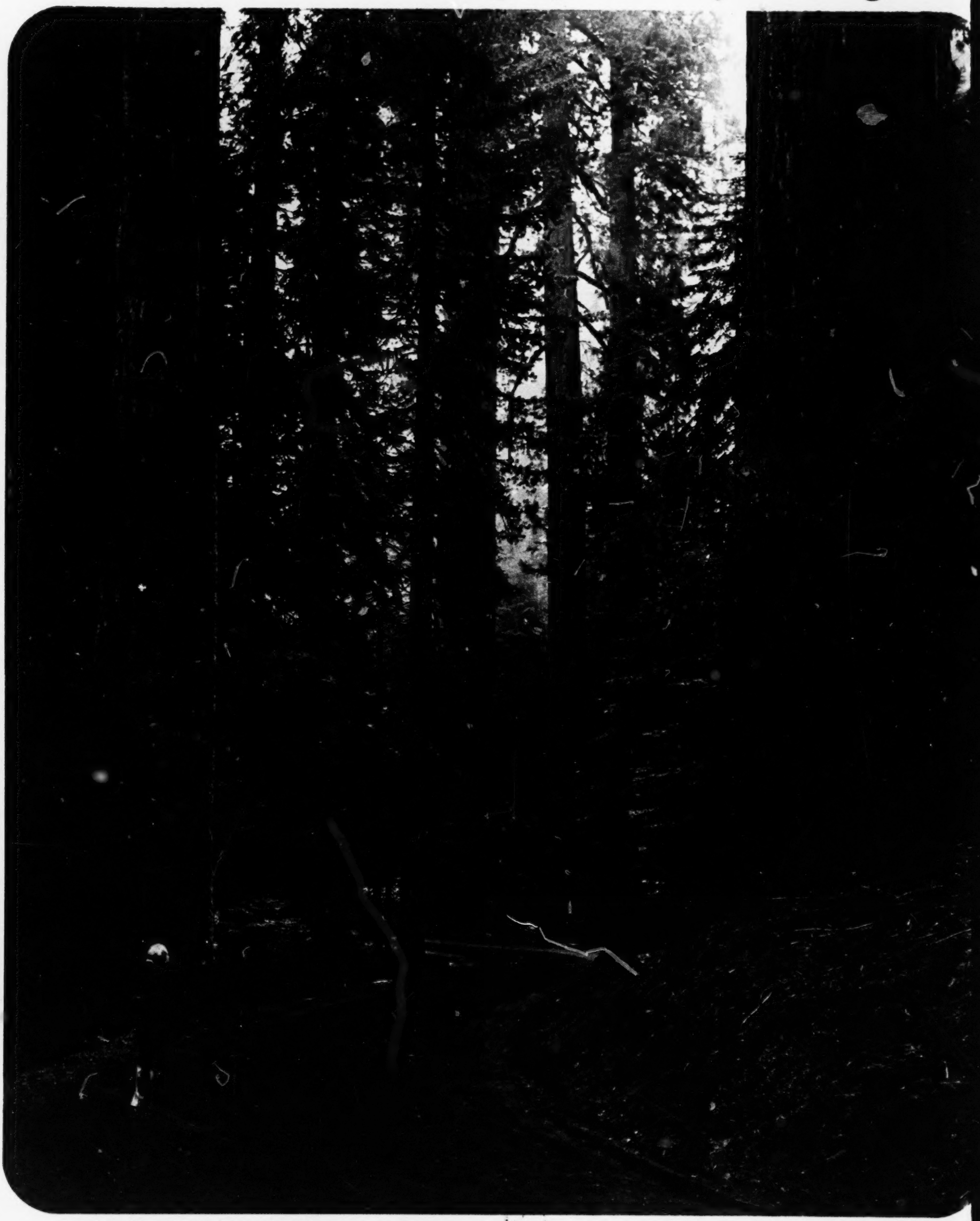


GRAND CANYON
and
. . . CANYONLANDS

CANYONLANDS
LOCATION: Southeastern Utah
SIZE: 257,640 acres
ESTABLISHED: 1964

Ray Atkeson — Western Publishing Co.

The cathedral magnificence of the ageless



Josef Muench — © National Geographic Society

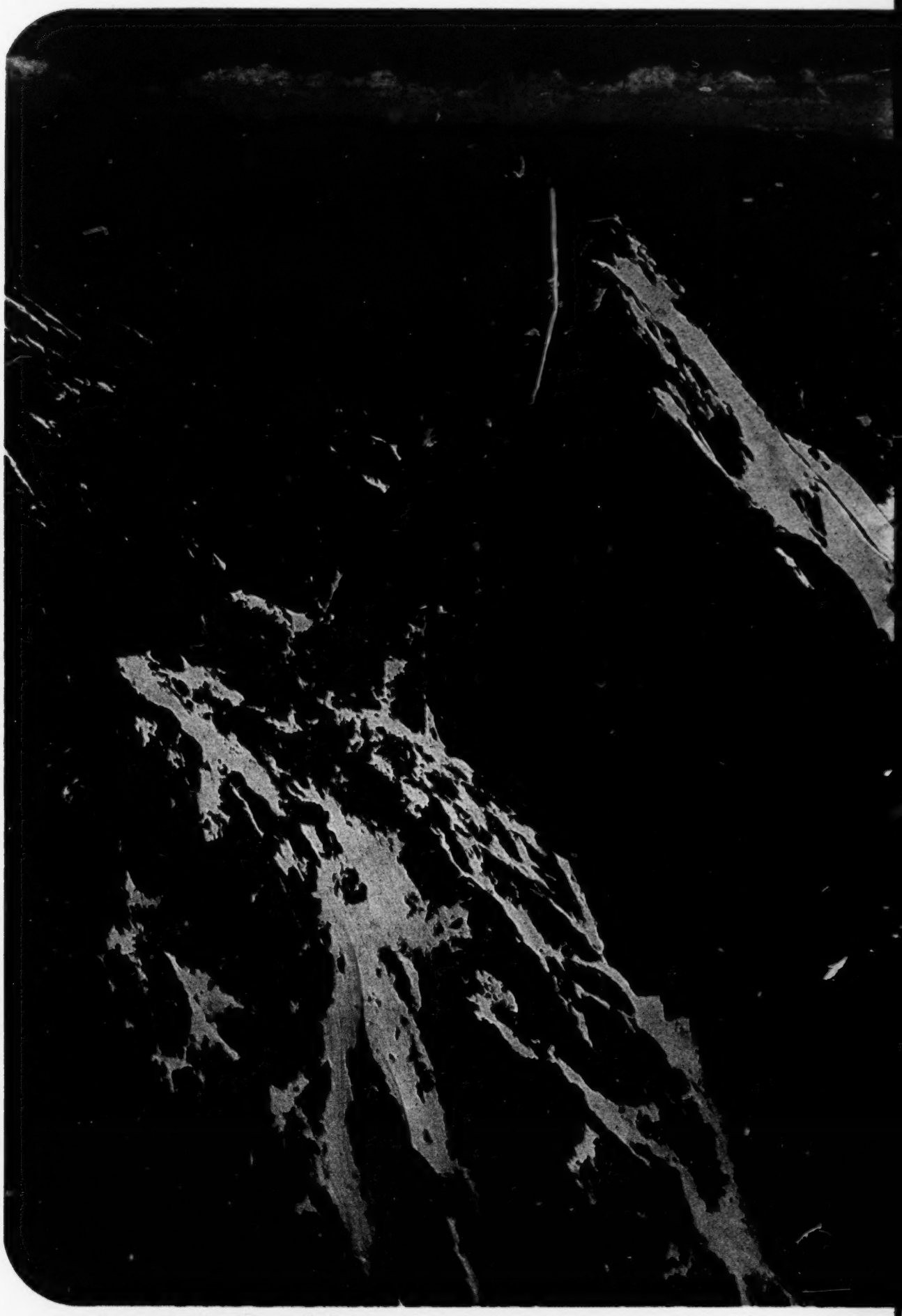
giants of . . . SEQUOIA.

All the birds of the heavens made their nests in its boughs; and under its branches did all the beasts of the field bring forth their young.

Ezekiel 31:6

SEQUOIA
LOCATION: Southeast Central California
SIZE: 385,413 acres
ESTABLISHED: 1890

GRAND TETON
LOCATION: Northwestern Wyoming
SIZE: 302,571 acres
ESTABLISHED: 1929



Dean Conger — © National Geographic Society

the lofty spires of . . . GRAND TETON

Country Beautiful Magazine

A National Park is the breath-taking scenic

© National Geographic Society

OLYMPIC
LOCATION: Northwestern Washington
SIZE: 888,558 acres
ESTABLISHED: 1938

variety of OLYMPIC.

Johsel Numkung and Ruth Kirk — "The Olympic Rain Forest," — University of Washington Press, 1966 — Audubon Magazine

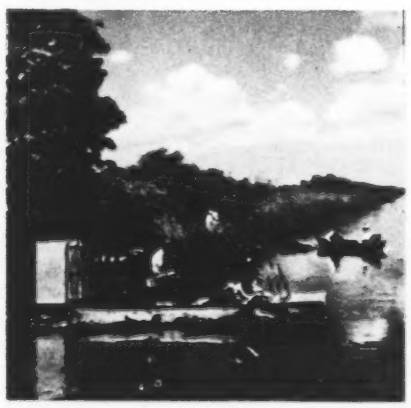
Country Beautiful Magazine

104

BIG BEND
LOCATION: Southwestern Texas
SIZE: 706,538 acres
ESTABLISHED: 1944

The majesty of early morn at BIG BEND *or the serenity of day's end at* EVERGLADES

EVERGLADES
LOCATION: Southern Florida
SIZE: 1,306,509 acres
ESTABLISHED: 1947



Gene Ahrens — Country Beautiful Magazine

GLACIER
LOCATION: Northwestern Montana
SIZE: 1,010,308 acres
ESTABLISHED: 1910

The grandeur of
GLACIER . . .

The autumn splendor of the
GREAT SMOKY MOUNTAINS,
SHENANDOAH,
and the
BLUE RIDGE PARKWAY.

GREAT SMOKY MOUNTAINS
LOCATION: Western North Carolina and Eastern Tennessee
SIZE: 511,096 acres
ESTABLISHED: 1930

SHENANDOAH
LOCATION: Northwestern Virginia
SIZE: 193,646 acres
ESTABLISHED: 1935
and
BLUE RIDGE PARKWAY
LOCATION: Virginia and North Carolina
LENGTH: 469 miles
ESTABLISHED: 1936

Glacier

Some 135 million visitors explored our National Park areas in 1966 and predictions call for 250 million annual visits by the year 2000.

Kings Canyon

It is a place for enjoyment . . .

Grand Teton

Yellowstone

Today mobile Americans can travel and enjoy the benefits of outdoor recreation with little concern for time and distance. The escape to the outdoors can place a heavy burden on recreation facilities.

John M. Kauffmann — © National Geographic Society

Zion

Enjoyment of Nature's finest gifts by young and old alike is the magnet that attracts visitors to America's outdoor playgrounds.

White Sands

exploration . . .

. . . outdoor recreation . . . and conservation.

A Family of campers dines under the giant Sequoias.

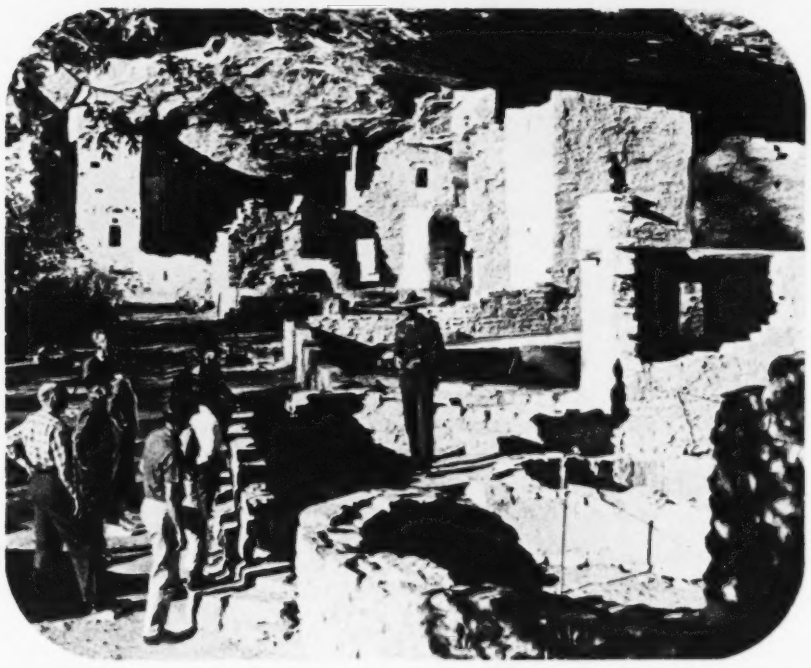
Models of conservation—our National Parks—preserve the best of America's outdoors for all time.

B. Anthony Stewart — © National Geographic Society

Leopard Lily

Mount McKinley

A National Park is the preservation of our nation's historic past . . .



Mesa Verde

. . . the learning of nature's ways and . . .

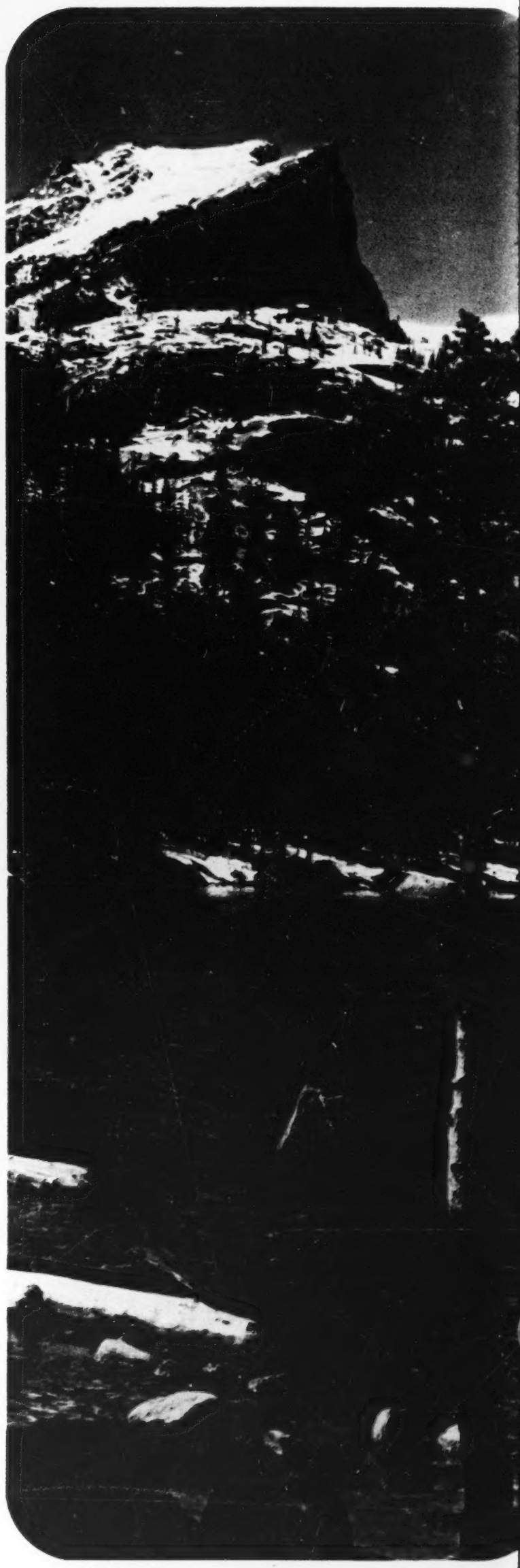
B. Anthony Stewart — © National Geographic Society

Sequoia Lupine Wildflowers

. . . the interpretation of all these wonders for man's understanding.

110

Jack Boucher — Country Beautiful Magazine



Rocky Mountain

112

One of the major objectives of the redwood conservationists was establishment of a Redwood National Park. During the 1920's and '30's, various Federal studies were made, recommending establishment of such a park, but the necessary legislative action did not materialize.

In 1955 a disastrous flood struck the Bull Creek area and threatened the ecology of entire redwoods forests. The conservation effort then shifted to emphasize preservation of watersheds to protect downstream groves.

Although the public is still without a redwood national park, 28 redwood State parks have been established through the cooperative efforts of the Save-the-Redwoods League, the Sierra Club, the State of California, and individual benefactors.

In 1963, the National Geographic Society, long active in preserving the redwoods, made a grant to the National Park Service to finance a special study of the coast Redwoods (Sequoia-sempervirens) of California. While the study was underway, President Johnson was briefed on the progress. Said the President:

> **The redwoods are one of Nature's masterpieces in North America—and in the world. Yet, at the present rate of logging and with destruction resulting from inadequate conservation practices, the future of the redwoods is in doubt * * * I have directed Secretary Udall to prepare a plan for a redwoods national park and to have it ready for presentation to the Congress next January.**
>
> **I have expressed my concern and determination to save our countrysides. I know of no better place to begin than in this work of saving the majestic redwood forests of the American West.**

In his Natural Beauty message to Congress, February 8, 1965, President Johnson again urged establishment of a redwood national park. In another message to Congress February 23, 1966, the President repeated the need for action to preserve the redwoods.

In its efforts to provide recreation and park areas for the large east coast population, the National Park Service has received strong support from Congress as well as the President.

On the Atlantic coast last year Congress authorized establishment of two additional national seashores at Assateague Island, Md., and Va., and at Cape Lookout, N.C. This brought the total number of seashores in the National Park System to seven. It is significant that 5 of these are along the east coast, where each day open space is becoming an increasingly precious element in the lives of millions of urban citizens.

In his remarks at the signing of the Cape Lookout National Seashore Act in 1966, President Johnson noted:

> **Great national parks and great national seashores, located in faraway distant places do not satisfy the needs of the people who are part of our urban civilization. The serenity of nature must be more than a once-a-year experience * * *. This experience should touch our daily and weekly lives.**

Late in the second session, the 89th Congress passed legislation establishing two new National Lakeshores—the first such units of the National Park Service to front on the Great Lakes, America's "fourth coast."

Pictured Rocks on Lake Superior in Upper Michigan sets aside 37 miles of lakeshore and Indiana Dunes, on Lake Michigan east of Chicago, takes in approximately 10 miles of shore.

In addition, the final days of the 89th Congress saw the authorization of the 77,000-acre Guadalupe Mountains National Park in the majestic alpine region of Far West Texas.

Water reservoir projects today are considered as significant for their outdoor recreation potential as for their primary purposes of supplying domestic and industrial water needs, hydroelectric power, or flood control. One such project authorized by the Congress this fiscal year is the Delaware Water Gap National Recreation Area in Pennsylvania and New Jersey.

Surrounding a 37-mile reservoir to be created by a dam near Tocks Island on the historic Delaware River, the new recreation area is only 65 miles west of New York City and 75 miles north of Philadelphia. It is within a day's drive for one-third of the people of the United States.

Walter Meayers Edwards — © National Geographic Society

New rangers are instructed with the aid of an imaginary park called Avalanche Peaks at the Horace M. Albright Training Center at Grand Canyon. This "boot camp" and another, the Stephen T. Mather at Harpers Ferry, West Virginia, are Mission 66 developments.

Such a national recreation area calls for the highest order of cooperation among Federal, State, and local officials. Development of the recreational use of the land and water will be the responsibility of the National Park Service. The Corps of Engineers will administer the project for water supply, flood control, and hydroelectric power. Individual States involved will continue their legal jurisdiction, and hunting—where permitted—will be in accordance with State game laws.

Finally, all Federal agencies will maintain close contact with the Delaware River Basin Commission to coordinate planning, development, and administration of the area within the comprehensive plan developed by the Commission for the water resources of the basin.

The process of purchasing land from private owners, coordination with local and State groups, and protection of individual rights will require a long development period. Many recreation areas included in the Delaware Water Gap National Recreation Area will not be available to the public until the early 1970's. This time lag illustrates the need for

immediate Federal, State, and local action to insure adequate recreation and parkland for the future. What is started today will be years in becoming a reality.

An area similar to Delaware Water Gap also has been authorized on the west coast—the Whiskeytown-Shasta-Trinity National Recreation Area near Redding, Calif. The Whiskeytown Unit of the new area will be administered by the National Park Service while the Shasta and Clair Engle-Lewiston units of the area will be managed by the U.S. Forest Service.

The interrelationship of the four Bureau of Reclamation reservoirs and the Federal lands surrounding them has called for careful planning and development by five agencies of the Federal Government in cooperation with the State and counties and private landowners to obtain maximum sustained public benefits.

In addition to administration of the area itself, the Forest Service, the Bureau of Land Management, the Fish and Wildlife Service, the Bureau of Reclamation, and the State of California all will continue to stress outdoor recreation in their present resource management programs on lands near the area. The Whiskeytown unit already is drawing thousands of vacationers for motorboating, fishing, swimming, and other outdoor activities.

Whiskeytown provides a window to the past—keeping alive that fabulous era of the Forty-Niners, and provides a door to the future—with recreation resources far more precious than gold.

In the southwest, a region where public recreation opportunities—particularly those related to water—are relatively scarce, the National Park Service has entered into cooperative agreements with other Federal agencies to administer several similar reservoir recreation areas. Now under construction by the International Boundary and Water Commission of the United States and Mexico is the Amistad Dam on the Rio Grande. Careful protection of the shoreline and development for public use will make the Amistad Recreation Area lake a compelling recreation focal point for residents and visitors alike.

On the Canadian River, the National Park Service will administer the Sanford Recreation Area in Texas in cooperation with Interior's Bureau of Sport Fisheries and Wildlife and Bureau of Reclamation. Sanford Dam is on the Canadian River, about 38 miles northeast of Amarillo in the central part of the Texas panhandle. In addition to reservoir-oriented recreation, the Sanford Recreation Area has the advantage of being next to the renowned Alibates Flint Quarries and prehistoric pueblo ruins recently set aside by the Congress as a national monument.

Extension of conservation and preservation concepts beyond the limits of park boundaries is reflected by the Service's National Landmarks program. This gives official recognition to historic and natural landmarks of national significance, but does not bring such sites into Federal ownership, unless more detailed study establishes their suitability.

A companion program, the National Survey of Natural Landmarks, has just started. Some 54 sites have been found eligible for landmark status, and 37 of these already have been registered. Eligible natural landmarks range widely in size, location, character, and ownership. For example: A heron-nesting area on Cape May, N.J., covers only 21 acres and is owned exclusively by the Borough of Stone Harbor, while the Lance Creek Fossil areas in Wyoming include approximately 290 square miles, owned by some 40 different persons and government bodies. Pinhook Bog in Indiana includes 27 acres of pond, bog, marsh, and swamp which are privately owned, while the Lake Agassiz Peatlands cover over 22,000 acres of bog owned by the State of Minnesota. A list of more than 800 potential natural landmarks has been compiled for consideration. Approximately 50 of these were under study at year's end.

Another new and imaginative concept of historic preservation is exemplified in the act of May 15, 1966, authorizing establishment of the Nez Perce National Historical Park in Idaho. Of the 22 separate sites that will comprise the new park, only the 3 principal sites—White Bird Canyon, Spalding, and East Kamiah—will be owned by the Federal Government and administered by the National Park Service. Cooperative agreements rather than outright ownership by the Federal Government will assure interpretive integrity and a unity of concept for the sites comprising the new park. Liberal use of scenic easements around the individual sites. would prevent destruction of historic and scenic values. The Nez Perce complex represents another partnership arrangement which points to a growing interest in joint responsibility for the stewardship of America's natural and historical heritage.

Like superlative scenery, history is also "where you find it"—sometimes where the people are, sometimes where they are not. Several historical sites and monuments were added to the National Park System during fiscal 1966—each casting additional light on our historic heritage.

Commemorating the driving of the "golden spike," which marked completion of the first transcontinental railroad in the United States, May 10, 1869, the Golden Spike National Historic Site has been authorized near Promontory, Utah. This park will tell the story of the "new" transportation system connecting the Atlantic and Pacific shores—replacing the stagecoach and making unnecessary the long sea voyage around Cape Horn.

Recent legislation commemorating historic events in the State of Kansas authorizes the Secretary of the Interior to give the city of Fort Scott technical advice, grants of money for land acquisition and development, and other help necessary to display the fort to the public. The citizens of Kansas themselves began the task, and the sites of the five major events referred to in the act already are in State, county, or local public ownership. These include Fort Scott, sites associated with John Brown in Osawatomie, the Mine Creek Battlefield, the Marais des Cygnes massacre ground, and the site of Quantrell's raid at Baxter Springs. The National Park Service is encouraging the city of Fort Scott and private owners to maintain these structures and open them to the public.

Congressional action during the year established the Hubbell Trading Post National Historic Site near Gonado, Ariz. Here, the sprawling adobe home of John Lorenzo Hubbell, its walls covered with paintings and lined with crowded bookcases, shows the richness of this reservation trader's life. Unlike his roving predecessors, the reservation trader lived in a fixed location near a particular group of Indians, and thus was able

to make his influence continuously felt—in a unique blend of philanthropy and business acumen.

Outstanding paleontological sites at the Agate Springs Fossil Quarries in Nebraska have been established as a national monument, providing a center for research, display and interpretation of scientific specimens, and exhibition of Indian artifacts and relics.

The National Survey of Historic Sites and Buildings has completed 37 of the programed 40 major studies in its survey of the Nation's historic sites and buildings. It also has completed 164 special studies of individual sites. Thus far, some 3,300 historic and archeological sites have been studied and 689 of these have been found eligible for designation as registered national historic landmarks.

Pecos National Monument in New Mexico is another area of exceptional historic and archeological importance recently added to the National Park System. Within approximately 342 acres of land lie the remains and artifacts of a 17th century Spanish mission and ancient Indian pueblo.

Contemporary history also received consideration in recent congressional enactments which authorized the Herbert Hoover Birthplace National Historic Site in West Branch, Iowa, and added Ellis Island as a part of the Statue of Liberty National Monument.

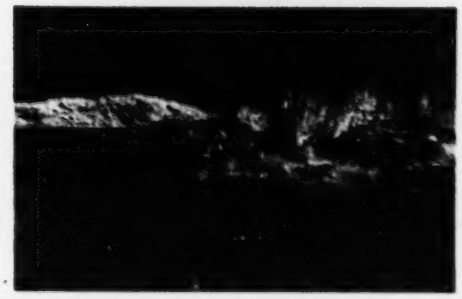
While much emphasis has been given to preserving natural areas the Nation is at last paying more attention to significant chapters in America's rich historical heritage—much of which still is not represented in today's parklands. In the past, stress has been placed on political and military history—on birthplaces and battlefields. Today, the craftsmen of yesteryear, the Industrial Revolution, the labor movement, medicine, science, the arts, and a host of other springs that have fed the mainstream of our culture are being sought, evaluated, and brought into the National Park System. Proposed for addition to the National Park System are such areas as Longfellow National Historic Site and Saugus Iron Works National Historic Site, both in Massachusetts; the Robert Frost National Historic Site in Vermont; and numerous historic sites in the Boston areas and Plymouth Rock National Memorial in Massachusetts.

Conservation of national park resources is developing a worldwide dimension. The Service now is reaching out in a variety of cooperative exchange and assistance programs with many nations. The preservation of beauty and outstanding natural environments, wherever they occur, is a challenge to all peoples in all lands. The protection and restoration of world-famous historical and archeological sites which serve to tell the story of mankind's progress is equally important.

The Department of the Interior has been particularly active in this field of international cooperation. During the year, Secretary Udall was the U.S. representative to the Inter-American Specialized Conference to deal with problems relating to the Conservation of Renewable Natural Resources in the Western Hemisphere, sponsored by the Organization of American States. Another example of increasing participation is the formal membership recently obtained by the Department in the International Union for the Conservation of Nature and Natural Resources. This will permit more active liaison with other countries in the conservation work of the IUCN.

The Delaware Water Gap National Recreation Area, as seen from bird's eye or human eye level, shows its dramatic potential for outdoor fun.

Wind smooths footprints and ruffles dune grass under lowering clouds at Cape Cod National Seashore.



(Above) Colonial National Historical Park at Yorktown, Virginia.

(Below) Trout season opens on Whiskeytown Reservoir, in California.

The global spread of the national park idea was stimulated by establishment of Yellowstone National Park in 1872. Today more than 80 nations have national park or equivalent reserve systems. The National Park Service works to encourage further development of a worldwide appreciation of the need for the protection of natural beauty, the preservation of indigenous plants and animals, recognition of the scientific values of natural environments, and preservation of historical heritages. As exchanges of information on methods and ideas develop, the United States stands to benefit greatly in carrying out this concept. Exchange programs are being developed with Canada, Japan, New Zealand, Australia, and other countries in Asia, Africa, Europe, and South America. Under an Agency for International Development program, a park naturalist is assigned for 2 years to teach at the African College of Wildlife Management at Mweka, Tanzania. An extensive program to develop parks and monuments in Jordan will involve technical assistance from a 12-man National Park Service team and still other programs are planned.

In cooperation with the School of Natural Resources at the University of Michigan, the National Park Service had conducted two "short courses" for national park and equivalent reserve leaders, attended by representatives from 30 other countries. The friendships these courses have stimulated among people of these lands rival in significance the values of the ideas and information exchanged. This "new dimension" in conservation promises to do as much to develop friendly and cooperative relationships around the world as to advance worldwide nature conservation programs.

To preserve that fast-vanishing aspect of our country known as wilderness, Congress passed a Wilderness Act in 1964. This law requires Interior's National Park Service and the Bureau of Sport Fisheries and Wildlife, and the Department of Agriculture's Forest Service to set aside as "wilderness areas" places where man and his works will not be allowed to dominate the landscape, sites where man himself will be a visitor who will not remain.

The act instructs the National Park Service to review roadless sections of 5,000 acres or more in the system and recommend whether such lands should be added by the Congress to the National Wilderness Preservation System. The National Park Service held public hearings during the past year regarding establishment of wilderness areas in the Great Smoky Mountains National Park of North Carolina and Tennessee. Public meetings were held in North Carolina and plans for preserving the area were made available to citizens. State government officials, members of Congress, local civic leaders, and others presented their views regarding the proposed "wilderness" areas.

Among management concepts adopted by the National Park Service in fiscal 1966 was establishment of Planning and Service Centers at three locations: San Francisco, Philadelphia, and Washington, D.C. By grouping professional and technical personnel into these three strategic locations, more effective use can be made of the various disciplines. This is especially useful in the study of proposed new areas to the National Park System. Each stage of the process of establishing new areas can now be controlled—from the initial studies and cost estimates, through the legislative process, and finally to the actual land acquisition and master planning.

Navajo Indians ride herd on their sheep amidst the colorful grandeur of Monument Valley, which sits astride the Arizona-Utah border.

Bureau of Indian Affairs

Ancient Indian religious beliefs, although varying from tribe to tribe, had a common theme—the oneness of man and nature. Dances, symbols, customs all reflected the

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Indian's awareness that his survival depended upon a close working relationship with his environment. The Indian people of this country were riding the Third Wave of Conservation centuries before the concept had been given a name.

The European settler learned many things from the Indian, but for three centuries he and his descendants tried to disregard or dominate nature, establishing a pattern of thoughtless despoliation as if there were no tomorrow. All Americans now are engaged in a great national effort to reestablish a harmonious relationship with nature. Hand in hand with that effort goes the task of helping the American Indian establish himself in a position of equality—economic and social as well as legal—with other Americans.

Becoming a 20th century American is most easily accomplished by leaving behind the major elements of surviving Indian culture and embracing the modern American way of life as one's own. But the Indian culture is based on a man-to-land ethic the country cannot afford to disregard. The Indian people must not be asked to abandon this part of their culture in their striving toward social and economic equality.

The Bureau of Indian Affairs is charged with helping the Indians and Alaska natives help themselves toward full participation in the complex life of space-age America. Although in the past decade about 55,000 Indians have left the reservations to establish new lives in cities and suburbs across the country, at least 380,000 still live on or near some 280 reservations and smaller land units scattered from Florida to Alaska. It is these reservation-inclined Indians that the Bureau is responsible for assisting.

One of the oldest agencies in Government, the Bureau has worked through many changes in official policy toward Indians, sometimes standing between them and those apparently bent upon their extinction. Forced from his traditional lands and harassed by countless cruelties and injustices, the Indian withdrew from the contest with onrushing civilization. Either through official policy or because of a self-imposed isolation, he found himself living in pockets of poverty, often on land no one else wanted.

Today many Indians live in partial isolation on often marginal land, with the habits of commerce and industry only scarcely developed. To help him, whole new concepts in development assistance are being created by the Bureau of Indian Affairs and the Federal Government as a whole.

Indicative of this new trend was the appointment during the fiscal year 1966 of a member of the Oneida Tribe as Commissioner of the Bureau of Indian Affairs. It was the first time in 97 years an Indian had been selected. Under the new leadership, the Bureau is restructuring its organization and moving toward what is a revolutionary concept for this old-line agency: To draw on Indian thinking in planning aid programs. The new approach also calls for intensive cooperation with the many other Federal agencies that offer financial and technical assistance in economic development, housing, education, and related activities.

The American dream of the good life, the active life, the life of self-determination, is viewed by the Bureau as the fire which should be rekindled in the hearts of the first Americans.

Above all, the Indian people are now being encouraged to draw on that most basic of all human resources—their own intelligence and initiative. The Indian is now being told not what he *should* do, but what he *can* do. Each tribe is an organized political body. As such it can and does make decisions which markedly affect the future of the tribe and its members.

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Aural-oral language method shown here helps Indian children develop sentence patterns rather than a vocabulary of individual words.

Use of office procedures (above), an understanding of electrical systems (below), and assembly of electronic components (right) are among the skills Indian people are learning.

Parent participation in the Bureau's schools is becoming more common. Here a Navajo mother plants a thumbprint to register her son.

Today's complex society requires of its members knowledge only an effective educational program can provide. As part of its "new look" the Bureau has unified its educational activities and assigned them to an Assistant Commissioner for Education—a newly created post. The program has been given the highest priority.

In approximately 275 schools and dormitories, including 26 high schools, the Bureau of Indian Affairs will enroll an estimated 59,800 Indian youngsters in 1966–67. In addition, more than 100,000 Indian children will be attending public schools in their localities. Most of the students in the Bureau schools will be "first generation," coming from homes with a minimum level of educational attainment and expectation. On the other hand, most of the students in the public schools have parents and grandparents who are comparatively well educated.

School construction programs have absorbed a large share of the Bureau's education funds and energies for 5 years. The Elementary and Secondary Education Act in 1965 has complemented the Bureau's 30-year-old financial aid program for needy public schools that serve Indian pupils. The companion programs markedly increase the resources of those public institutions which attract a larger percentage of Indian students each passing year.

Many Indian children enter their first year of school under a tremendous handicap—lack of knowledge of the English language. Several Indian languages, such as Navajo, are so different from any European language in structure, thought patterns, and sounds that traditional methods of foreign language instruction are virtually useless. Under Bureau guidance new methods of teaching English are being developed and used. Typical of these is the aural-oral system which groups words into thought patterns expressing an idea or an action rather than the old-style word-for-word translation system so ill-suited to Indian languages.

The Bureau also is working with public school districts in Indian areas to help them make the best use of new Federal programs such as the Economic Opportunity Act's Operation Head Start. Again, much of the emphasis is on teaching English as a second language and upon programs which can help the Indian child understand and cope both with the demands of the educational system and American culture.

If a child's first years in school determine his success in making use of the education available to him, it is equally true that his last years in school will determine how successfully his adult life will fit the pattern of the world around him.

For that reason the Bureau of Indian Affairs in fiscal 1966 aided more than 1,800 Indian college students through its higher education grant program. These students, enrolled in both 2- and 4-year programs, received more than $1.4 million in grants. Their desire to help meet the pressing needs of their people is evidenced in the fact that the majority has elected to study in the fields of education, health, and social welfare.

Last year 116 students were graduated from 4-year colleges and universities, more than double the number of 5 years ago. In addition, many Indian young people attended college with assistance from tribal funds, colleges, private organizations, States, and through their own and family financing.

Some of these young people will undoubtedly join the 366

Indians who now are staff members on Bureau school faculties. These professional people represent 16 percent of the total staff and 70 different tribes.

Educational inadequacies of the past have left many reservations with a legacy of uneducated or undereducated adults. These people, most of whom must provide for a family, find it extremely difficult to cope with the complexities of modern society. For them the Bureau provides an adult education program. In fiscal 1966 it assisted more than 30,000 Indian adults in some 200 communities in 16 States. Each year sees a large increase in the number of adult Indians enrolled in the general educational development courses which provide them with a certificate equivalent to a high school diploma, the passport to many new job training opportunities.

A pilot program on a reservation location soon will test the concept—already demonstrated by considerable research—that new learning methods and new educational materials will enable Indian adults to learn at a rate not believed possible a few years ago.

In their growing awareness of the urgency of education, many tribes are upgrading local standards. Bureau records show that 61 tribal groups have made provisions for compulsory education in conformity with the regulations of the States in which they live.

The Bureau's policy is to encourage the growth of locally controlled public schools for Indian children and to urge Indians to become active in all phases of their community life. Notable progress is being made in relating Indian children and their parents to public school programs. In many schools, Parent-Teacher Associations, practically nonexistent for years, have developed dynamic programs.

Some school districts are conducting special studies to determine what special educational services may be provided to enable disadvantaged Indian children to compete on better terms with non-Indian students. Efforts are being made to promote cultural understanding between Indian and non-Indian in an attempt to reduce dropouts and increase average daily attendance.

Several schools administered by the Bureau are partially supported by public school funds, mainly used to hire personnel, purchase school supplies, and provide transportation. Elected school boards work with the Bureau in administering the schools.

Even more dramatic than the increasing tie-in with public schools is the newest of all the Bureau's approaches to Indian education—that of contracting with tribal groups to operate schools. The first such contract was effected in 1966, when a group of Navajo citizens formed a corporate organization to conduct experimental programs at the Bureau-operated Rough Rock Elementary School. The operation of the combined day and boarding school is supported financially by the Bureau of Indian Affairs. The experimental program of remedial, special counseling, and language teaching is funded under the Economic Opportunity Act, and directed by the Navajo lay group which has hired specialists for the experiment.

While the main thrust of its education program is to close the gap between the Indian pupil and his non-Indian counterpart and to help Indians prepare themselves to participate in a public school situation, the Bureau also maintains a unique institution designed to perpetuate and dramatize Indian culture. This is the Institute of American Indian Arts at Santa Fe, N. Mex. Students from this school, both high school and post high school, have gained national recognition for their original work in art, drama, textiles, ceramics, poetry, and dance.

The school provides a growing reservoir of trained and educated people who can help the Nation understand the significance of many aspects of Indian culture. At the same time, the Indians' own awareness of their cultural heritage and its relevance to today's society is intensified.

The Bureau of Indian Affairs cooperates with the Indian Arts and Crafts Board, a separate entity in the Department of the Interior, to foster and promote authentic Indian arts and crafts. This activity serves the double purpose of strengthening and preserving various aspects of many Indian cultures and of establishing standards which separate the genuine from the imitation. In addition, the Arts and Crafts Board has helped establish training programs to teach young Indians and Alaska Natives craft production methods that blend modern mechanical techniques with traditional materials and designs.

The Indian's search for economic self-sufficiency as a family unit and as a community must be successful if he is to come to terms with the society about him. Two avenues are open to the Indian community seeking economic viability. Individual members can leave to find opportunity elsewhere or they can bring opportunity to themselves. The Bureau of Indian Affairs provides assistance in both cases.

For those who elect to leave the reservation the Bureau has an extensive "relocation" program which provides vocational training, financial aid in relocating families, and job placement services. Indians seeking the skills necessary for them to compete in industrial America can choose from several hundred different courses in numerous occupational fields. Almost 300 educational institutions in 23 States have been approved for this type of study. Once trained, the Indian receives financial help and advice in finding a job, moving, and adjusting himself and his family to the new environment.

In the past 10 years this program has helped 52,000 Indians find a new and self-sufficient way of life off the reservation. About 7 of every 10 Indians who begin this training complete their courses and take jobs, a rate comparing favorably with that of the Manpower Development and Training Act nationally. The Bureau has had little difficulty in finding jobs for graduates of this program.

Many Indians cannot or do not wish to sever their attachments to reservations. At first glance this would appear to discourage business development. However, the Economic Development Division of the Bureau of Indian Affairs is finding considerable interest among businessmen and industrialists in locating in Indian areas where manpower is available.

The Bureau provides technical aid to industries, helping them locate sources of capital, and providing on-the-job training contracts for Indian employees. The immediately measurable result of the Indian industrial development program is the number of jobs created. Recent figures indicate that more than 90 industrial plants have launched successful

operations or are soon to open. Together they offer an employment potential of about 6,500 jobs, more than 4,100 of them now held by Indian workers. Based on today's minimum wage, these plants provide potential income of nearly $17 million annually, with Indians earning $9 million of this.

The manpower potential is great, particularly for skills requiring dexterity and attention to detail. Among other talents, Indian workers have demonstrated exceptional eye-hand coordination as well as the patience to turn out good work in competitive, monotonous, routine operations. Many of the jobs in the world of miniaturized electronics and space technology are tailormade for Indian skills. Furthermore, the small size of the components reduces transportation problems that affect remote reservations.

One example is a newly expanded plant at Rolla, N. Dak., which turns out tiny drilled synthetic sapphire and ruby jewel bearings for precision instruments used in the defense, space, and aeronauts industries. Indians from the nearby Turtle Mountain Reservation constitute about 70 percent of the plant's work force and have achieved a high-quality production record, averaging only 10 defects per 40,000 bearings. This record is all the more impressive when one realizes that 25,000 such bearings can be held in a tablespoon.

On the Pine Ridge Reservation in South Dakota, a new but small industry meant a transition from tents and log shacks to modern homes for Indians. Other homes were remodeled and stoves, refrigerators, and indoor plumbing were added. School attendance increased. A home for the aged was built and a modern shopping center was constructed.

Since the development of Indian industrial areas often involves non-Indian communities, many tribes work out cooperative agreements with their non-Indian neighbors. More than 65 local industrial development corporations or foundations already have been formed with Bureau assistance. Such organizations, with Indian participation, often are the focal point for marshaling an area's resources and are the community agency for participating in other Federal- or State-sponsored programs. Thus far, 32 tribes have formal development programs and 46 have created industrial development committees.

Industrial development activity requires funding. Accordingly, tribes have earmarked some of their own money for this purpose. By June 1966, more than $12 million had been set aside to assist in bringing industry to reservations. Additional capital investment from private sources in brick, mortar, and equipment totaled about $60 million.

In addition, the Bureau of Indian Affairs operates a credit program involving nearly $234 million. Only $24 million represents Government funds. The tribes are using $53 million of their own money, and $173 million has come from private sources.

By law the Secretary of the Interior is responsible for tribal funds held in trust. These trust funds have traditionally been kept in the U.S. Treasury, where they draw steady but comparatively low interest. The Bureau hopes that sound and prudent development corporations can be formed and partly financed with tribal funds. This type enterprise has an element of risk not found in the Treasury vaults, but it also possesses the potential to increase markedly the Indians' return on these trust funds while simultaneously encouraging development of new industry and commercial enterprises so necessary for long-term tribal self-sufficiency. That there is potential on Indian reservations which local development corporations could utilize has been thoroughly proved by more than 100 feasibility studies.

Recreation development, based on Indian culture and the land on which he lives, holds great promise. Facilities for the public range from 200 campgrounds to restaurants, motels, and luxurious lodges and ski resorts. The speed with which the Indians, with the help of Bureau of Indian Affairs advisers, have expanded their recreational operations can be illustrated by the fact that in the early 1960's an estimated 3 million visitor-days' use of reservation outdoor recreational facilities was forecast for 1965. Actually 1965 saw 6.5 million visitor days' use. Supplementing outdoor recreational activities are more than 250 costumed ceremonials, dances, feasts, and celebrations open to reservation visitors. These activities, and art crafts produced for sale to the tourists, also help keep alive for the Indian and for the Nation the heritage of the first Americans.

The land offers great potential for the Indians' own use, as well as for tourism development. In a variety of land and water conservation and irrigation programs the Bureau assists Indians in improving their forests, farms, ranges, herds, to increase income to the tribal members. These resources, if fully developed and used, could provide a livelihood for about 60,000 Indian families. In addition, the mineral resources of some areas are providing new avenues of tribal income from leases and royalties.

Nevertheless, visitors to America's Indian reservations will still see, along with some of the Nation's most beautiful scenery, some of its worst rural slums. Isolated physically and emotionally from the rest of the country, some Indian families stagnate in living conditions that would have been judged primitive even 50 years ago. Some Bureau programs are aimed at helping the Indian help himself to understand and compete in the sophisticated society of our times. Others, more direct, attack the hard core of poverty that exists on too many reservations. An example is the housing development program. Because most Indian families have low incomes, the Bureau and the tribes have concentrated on developing public housing programs. An agreement has been reached with the Housing Assistance Administration (formerly the Public Housing Administration) of the Department of Housing and Urban Development, to help tribal governments and tribal housing authorities develop and manage public housing programs until they have the experience and staff to operate their own.

Two types of public housing programs are under development on Indian reservations: Conventional low-rent and mutual-help.

The low-rent program operates exactly as it does in non-Indian communities. Loans are made to a tribal housing authority for the design and construction of the project. When the Housing Assistance Administration approves the plans, the housing authority lets construction contracts. Thus far, 699 low-rent units are completed and occupied and 453 were under construction at year's end. Rentals range between $45 and $55 a month, including utilities.

The housing program which has aroused the greatest interest and enthusiasm among Indians is the mutual-help program. Sixty-three Indian housing authorities on 62 reservations have 2,650 mutual-help houses in various stages of development. Under this program the Housing Assistance Administration provides the local Indian housing authorities with funds for building materials and specialized labor. The Indian families participating in the project donate their labor as a down payment.

For those families which cannot qualify for assistance through public housing, the Bureau has developed a housing improvement program. Through it, the Indian family may build better houses or rehabilitate those they already own. In the belief that the home must be the focal point from which to work toward a reasonable standard of living, this program is designed to instill pride in home ownership. Such pride makes possible better housekeeping practices, improved health conditions, better child care and education and improved family stability.

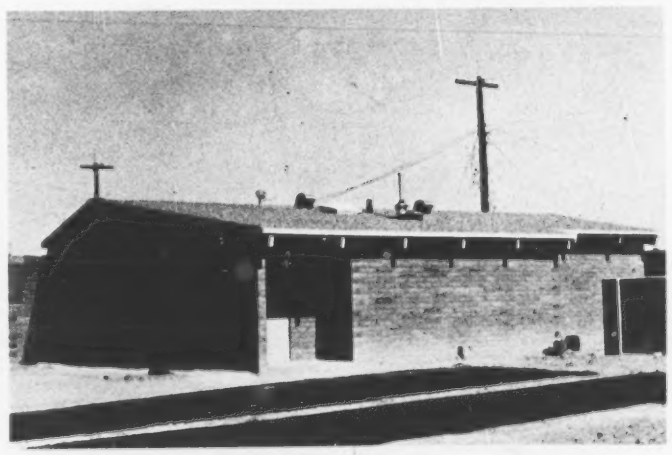
Another attempt to assist those living in the most primitive Indian housing has been launched by the Office of Economic Opportunity on the Rosebud Reservation in South Dakota. For Indian families with very low incomes, 375 prefabricated dwellings are being manufactured. Admittedly these are minimum-type structures--"transitional" houses. They contain neither electricity nor running water, although provisions for both at a later time are included. They are centrally heated and weather tight and better than the present housing of those families who soon will be occupying them. The project serves the dual purpose of improving housing and creating jobs for Indians in the prefabrication plant. Cooperating in this project are the Department of Housing and Urban Development, the Public Health Service, and the Bureau of Indian Affairs.

Although Indian reservations have large pockets of extreme poverty, hopeful signs indicate that the work of the Bureau, of other Government agencies, and of many private groups is beginning to achieve results. For many years the number of Indians needing welfare assistance from the Bureau increased regularly. In fiscal 1966 the number requiring such assistance was about the same as in fiscal 1965, indicating an improvement in employment opportunities. Such aid is provided only to those needy Indians who are ineligible for public assistance under the Social Security Act or through other public programs. The Bureau continued to provide social services in its welfare program to help Indians cope with serious social problems, and child welfare services for Indian children, including arrangements for the care of dependent, neglected, and handicapped children.

Increased recognition and use has been given the Indian adoption project, sponsored jointly by the Bureau and the Child Welfare League of America. In the year just ended, 55 Indian children who could not be adopted in their own States were placed in adoptive homes in the east and midwest, with the assistance of established adoption agencies, and a national adoption exchange under auspices of the Child Welfare League was begun as a pilot project to facilitate interstate adoptions for all children.

Information and counseling concerning family planning services were made available through all reservation welfare

This proud 81-year-old Nez Perce Indian (at right) sees a brighter future for his people in recent education and housing programs. Pima-Maricopa children (above) are delighted with tribe-sponsored Head Start program. Home below is one of 60 low-rent units built by PHA and Navajo Housing Board.



Country Beautiful Magazine

offices, and Bureau personnel cooperated with the Public Health Service to help Indians desiring these services.

Indian initiative toward self-improvement is demonstrated in the widespread tribal acceptance of various Office of Economic Opportunity programs. Applications from Indian communities—or Indian groups in cooperation with non-Indian communities—for assistance under the Community Action program nearly tripled during the past year. Investment by the Office of Economic Opportunity was $19.4 million. These programs included the highly popular Operation Head Start to prepare preschoolers for the first grade.

The Neighborhood Youth Corps—providing part-time employment to enable high school students to stay in school—enrolled 39,000 Indians in 1966, about double the 1965 figures. Forty-nine Indian communities had requested and received VISTA aid by the middle of 1966; and 10 Indian reservations agreed to host Job Corps trainees. Eight such centers were established during the year.

The Indian of the sixties has shown considerable talent in finding the funds necessary to finance his progress toward equality with all Americans. Additional sums are coming to him in recompense for past actions which took advantage of his vulnerability before the onrush of Western civilization. These are the awards of the Indian Claims Commission, an independent tribunal created by the Congress in 1946 to hear and determine land claims of tribes, bands, and other identifiable groups of American Indians.

During the past year, 12 awards, totaling $38.8 million, were made. However, appeals delayed the disbursement of some funds. More than $207 million has been awarded since 1951. Another indication of the growing financial sophistication of the tribes is the fact that this money now usually is put to work in some of the many economic improvement projects mentioned earlier.

The society that is America today has gained much from the Indian. His words, ideas, and skills have all been a part of the great melting pot. Now from that meld of cultures and nationalities the Indian is taking other ideas and other skills which he must have to stand equal with his neighbors. He is learning that the balance which sustained him in nature can be restored and maintained in a more complex age.

The Virgin Islands

The Virgin Islands, possessing no important mineral, timber, or other such raw materials, have concentrated their conservation efforts toward protecting and propagating other natural assets. The islands are blessed with excellent climate, magnificent beaches, great natural harbors, and convenient access to the sea and its boundless varieties of marine life.

The Virgin Islands, particularly St. Thomas, since their colonization 300 years ago, have been plagued by limited fresh water sources, and recently the Virgin Islands Government has taken a leading role in pioneering the use of desalted sea water. In fiscal 1966 the Government dedicated its second desalination plant on St. Thomas. Capable of converting 1 million gallons of sea water daily, this plant now supplements an older installation which produces approximately 300,000 gallons daily.

Realizing the need to conserve fresh-water resources, the Virgin Islands Government has had the 3-year services of a Geological Survey team. Their studies resulted in the creation during the year of a Water Resource Commission, which will oversee the implementation of recently passed legislation governing use of underground water.

Soil conservation efforts in the Virgin Islands during fiscal 1966 saw the U.S. Army Corps of Engineers starting a comprehensive basin planning program for the islands. This federally financed survey of flood-control needs will provide recommendations for such a conservation system in the islands.

The Virgin Islands possess a rich cultural heritage that extends back to the days of Danish rule, reflected in the many historical sites, landmarks, and architectural patterns. To protect these vestiges of the past, a measure was enacted by the Virgin Islands Legislature in fiscal 1966 creating a Board of Architectural Review and establishing a Registry of Historic Buildings for the Island of St. Thomas. The Board will pass on all restoration plans and further construction within a given area to be designated the St. Thomas Historic District. A similar district already exists in the town of Christiansted, St. Croix.

Protection of beaches on the three islands is a never-ending effort of the Government, and more beaches on publicly owned lands are being developed for the islands' citizens.

These sugar mill ruins, like the Annaberg estate they are part of, date from the mid 1700's and add a picturesque historic touch to the Virgin Islands National Park, on lovely St. John Island.

Trust Territory of the Pacific Islands

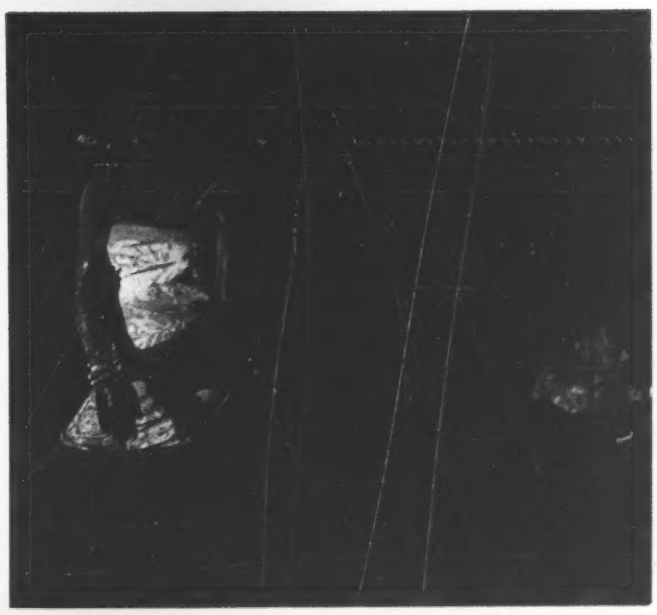
Economic and political development of the territory's 93,000 people can be achieved only by cooperative and progressive efforts toward unity. The Congress of Micronesia, established in 1965, already has begun to unify the area politically.

Educational development, begun in 1962, now consists chiefly of consolidation of gains and programing for the best use of expanded facilities. Hundreds of students were able to continue education through construction of 213 new elementary and 16 new high school classrooms. Some 142 American teachers were on the staffs of the public schools. More than 260 students were given full Government scholarships for the school year 1966–67; another 100 were granted partial scholarships.

Of primary significance to the territory's educational program were its inclusion in the U.S. Elementary and Secondary Education Act of 1965 and the extension of Peace Corps activities to the territory.

A survey of public health conditions was conducted by the World Health Organization and recommendations made to improve services to the islanders. An immunization program was 95 percent complete except in the scattered atolls of the Marshall Islands district. The technical staff of the Department of Public Health was increased by addition of a dentist, pharmacist, and environmental health specialist.

Economic resources are being studied in depth by a team



The handsome, casual Polynesians of American Samoa are descended from daring adventurers who criss-crossed the Pacific in tiny outrigger canoes. The U.S. protectorate is carefully preserving Samoa's natural beauty but at the same time opening new jobs at all levels and helping Samoans work into positions of authority, where they control their own future.

of experts from an internationally known consultant firm. Special emphasis was placed on factors related to the development of a sound economic base. The great economic potential of the ocean was being tapped as operations of a major U.S. seafood company continued in Palau district. The Palau shipyard launched a 75-foot tuna fishing vessel manned by a Micronesian crew. Agricultural experimentation, improvement of the copra industry, and development of a potential tourist industry continued as basic projects.

Conservation and proper use of natural resources and establishment of parks and recreational areas were being planned through forestry, land management, and community development offices.

Transportation and communications continued largely marginal. Water, power, and sanitation facilities still were far short of standards necessary for aiding development of the widespread area of Micronesia to its full potential.

Guam

The tropical lagoon fronting the capital city of Agana is picketed with signs reading, "Water Polluted—Not Recommended for Swimming."

A temporary causeway stretches to the reef across this same lagoon, making possible the construction of a new sewer outfall. With completion of the outfall the "Not Recommended" signs will come down; a natural resource will have been renewed. This is the face of Guam today. A program of planning, coupled with large capital expenditures, is producing a clean, well-designed, and thriving American community in a jewellike setting 3,000 miles west of the nearest State, Hawaii.

The people of Guam, true to their island heritage, are aware of the scarcity of land, and the importance of conserving those natural features which contribute to the island's beauty. An islandwide master plan recently was completed. Detailed planning within the rapidly urbanizing areas of the island is underway. An interim outdoor recreation plan, "Guahan—Sagan Minagof, Sagan Descanso" (We have—A place for fun, a place for relaxing) is complete, and a full-scale recreation plan was scheduled for submittal to the Bureau of Outdoor Recreation before December 31, 1966, and two important projects were being readied for Bureau approval. Another year should find the community with a centrally located public swimming pool and a fully developed surfing facility.

As a relatively undeveloped territory, Guam is taking advantage of all programs that offer support to conservation and recreation efforts. Tentative studies by the National Park Service have indicated the potential for establishing a War in the Pacific Monument and a National Seashore. Feasibility studies on both should be completed within a year. A design study by the Battle Monuments Commission has been submitted and approved, and swift action is anticipated to complete this monument to American servicemen who liberated the territory in World War II.

Guam is also using Economic Opportunity Act funds to set up a youth conservation corps. Members of this corps will clear trails and improve scenic and historic sites throughout the island.

Several projects reflect the private community's involvement in the overall resource effort. One-fifth the local contribution to a public swimming pool project is being donated by various civic organizations. Other groups are building a pavilion at the largest public beach park, are engaged in beautification projects in downtown Agana, and are participating in general cleanup and disposal projects in scenic rural southern villages.

The new dimension in the Guam program is the increased awareness, both within the Government and in the community, of the scope of the task. The challenge is being met by a united front of Government and responsible citizens who recognize the need for clear and farsighted planning, the desirability of using all avenues of aid, and the necessity for contributing leadership and hard work to the program.

American Samoa

Despite a disastrous hurricane in January 1966—the worst storm in modern Samoan history—the Pacific territory made perhaps its greatest social and economic progress in the past fiscal year. The tragedy of the destruction of 75 percent of the housing in the territory, and the loss of 60 to 80 percent of the staple foodstuffs on the island, was turned into a benefit when the United States rushed to the aid of its American nationals and their neighbors. The Office of Emergency Planning financed the construction of several prototype, modern sanitary houses that have been adapted from a basic Samoan architectural style. Congress appropriated $2½ million for a loan fund so additional houses could be built and so all houses could be improved with sanitary facilities.

The American Samoan Development Corporation launched its first big project—a magnificent $2 million luxury hotel complex. By year's end it was fully occupied and has every prospect of financial success. Furthermore, it became a major stimulus for development of a tourist industry in the territory. Happily, at the same time, the fishing industry of the region enjoyed a resurgence and, by the end of the year, the two major packers in the territory and their container supplier were working overtime to process the harvest from the sea. Approximately 50 individual enterprises sprang up during the year to support the hotel and the booming marine industry.

The educational television system for American Samoa came nearer to completion. Three additional television channels were added, bringing the total to six, All grades through high school were using educational television material. The second high school in the territory, at Leone, became fully operational. The high school in the Manu's group of islands was scheduled for use before the end of 1966. Plans for the fourth and last high school (for the eastern district of Tutuila) moved forward. Its construction will complete the rebuilding of the entire educational system in Samoa within a 5-year period.

Office of Coal Research

The Office of Coal Research continued during the year to develop improved methods for using the Nation's coal. Work was done by contract (with qualified research organizations outside Government) seeking increased efficiency which, in turn, would mean less waste and less pollution.

Projects were underway for developing practical methods of producing liquid fuels and pipeline gas from coal. Improved methods of generating electricity from coal give promise of upgrading the value of the Nation's coal reserves while simultaneously reducing the discharge of flyash and noxious gases to the atmosphere. The improved methods of power generation, if successfully developed, would require much less cooling water than that used by present thermal plants.

In the West, less need for cooling water would release substantial supplies for other purposes and also permit installation of thermal powerplants at sites not now considered feasible. In other areas where thermal pollution (heating) of rivers has jeopardized or destroyed plant and animal life, the trend could be reversed.

A coal filter process was being developed to purify sewage and industrial wastes. Another research project was centered on a method for using flyash to make high-grade brick. Such a process could provide an economic incentive for improved recovery from stack gases of this now largely wasted material.

Office of Oil and Gas

By the nature of its operations, the petroleum industry in the United States is deeply involved with other resources in addition to oil and gas. It produces enormous quantities of salt water—three barrels, for each barrel of crude oil brought to the surface. These brines must be disposed of so that they do not contaminate fresh-water sources. The refining segment of the industry is one of the largest industrial users of water, which must be returned to the streamflow suitable for the next use. Oil and gas are frequently found under areas dedicated to other activities—under cities, wildlife sanctuaries, or the offshore waters close by residential and resort areas, for example. The service station is an ubiquitous neighborhood fixture.

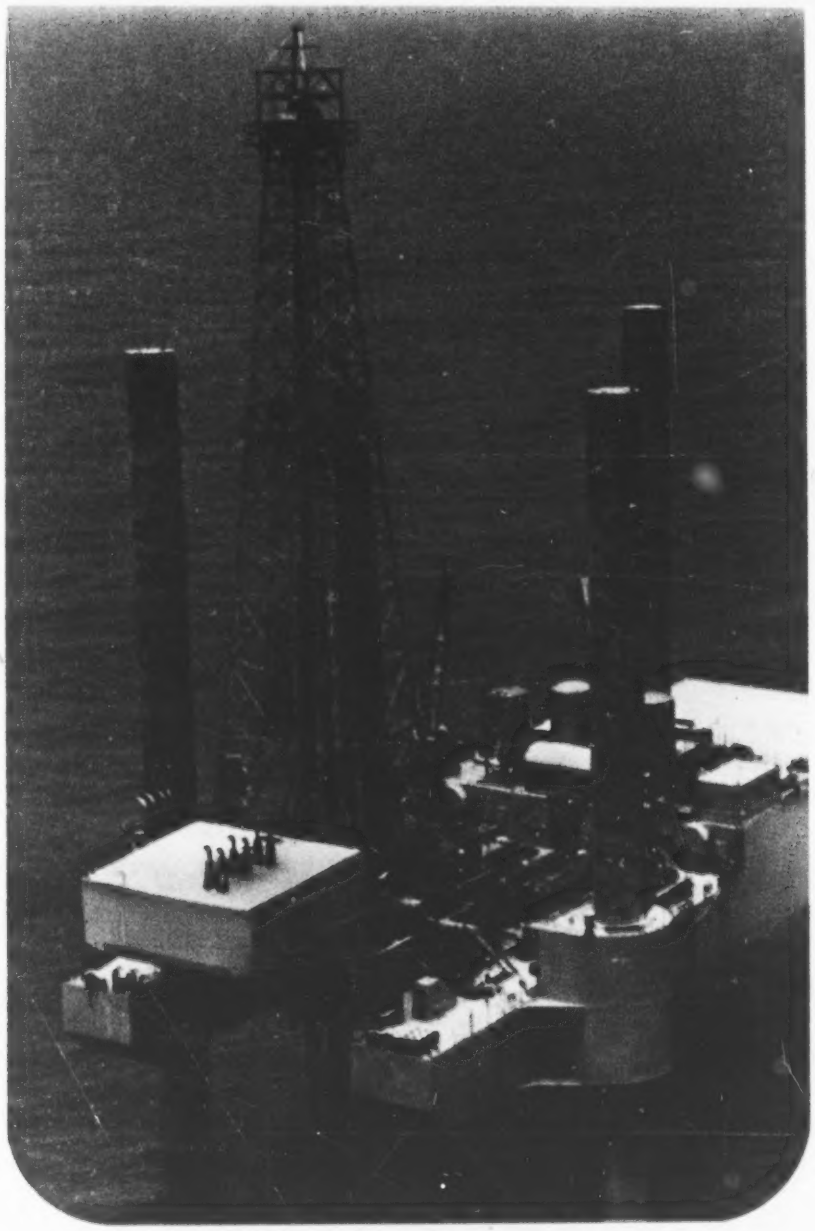
In its roles as the principal channel of communication between the Federal Government and the petroleum industry, and as liaison office with various State conservation agencies, the Office of Oil and Gas strongly supports measures which further the cause of conservation. The cooperative action of Government at Federal, State, and local levels with the petroleum industry is producing gratifying results.

During the past fiscal year the Office of Oil and Gas was instrumental in securing the cooperation of the petroleum industry in supporting the President's programs to develop the most precious resource of all: The nation's youth.

Oil Import Administration

Presidential Proclamation 3279, issued March 10, 1959, authorized the Secretary of the Interior to establish the Oil Import Control program and the Oil Import Administration to insure a stable, healthy oil industry in the United States capable of exploring for and developing new domestic petroleum reserves to replace those being depleted. Bases of the program are the certified petroleum requirements of the national security.

To insure attainment of the objective, Presidential Proclamation 3279 instituted an import control system covering petroleum and its principal products. The control program,



Aquia — Chem., Inc. — Cleaver Brooks Co.

This sophisticated drilling rig, 12 miles off Point Isabel, Texas, is tapping our billions of barrels of offshore oil.

administered throughout fiscal 1966, was designed to maintain the capability of the domestic industry to "seek and find" the required reserves.

Alaska Railroad

Conservation normally results from planned cooperation with nature and nature's forces. But there are times and places when conservation means a struggle against the destructiveness of nature's violence. For approximately 3½ minutes, March 27, 1964, Alaska was shaken by an earthquake estimated by the Geological Survey to be the most intense ever recorded in North America. A major victim of the temblor was the Alaska Railroad, a common carrier that has been operated for the Federal Government by the Department of the Interior more than 50 years.

Quake-generated earthslides, land subsidence, seismic waves, oil fires, floods, as well as earth shocks which damaged or destroyed track and roadway, bridges, buildings, rolling stock, equipment and lading, called for expenditure of about $27 million before rehabilitation of the railroad was 99 percent complete at the end of fiscal 1966.

Just after the close of the fiscal year the last great effort of restoration, the rebuilding of port and rail facilities in Seward, was completed. The dock, warehouse, and yards then were formally dedicated.

Employees of the Alaska Railroad were awarded a unit citation for a "remarkable and praiseworthy performance" in restoring the railroad to preearthquake standards. Officers and employees accomplished what the citation described as a "seeming miracle." Hundreds of bridges and culverts along the approximately 500 miles of track were repaired or rebuilt. Thousands of cubic yards of fill were placed where roadway had sunk 6 to 10 feet. Earthquake-generated slides, one a mile and a half long, were removed from the right-of-way and new ties and rail put in place. Buildings were restored or reconstructed and equipment was repaired or new equipment purchased.

Emergency repairs which enabled the railroad to resume freight and passenger service within a few weeks of the earthquake were accomplished almost entirely by Government employees. Much of the remaining work of rebuilding was performed by private contractors.

On October 15, 1966, President Johnson signed a bill creating this country's 12th Cabinet unit, a Department of Transportation. The Alaska Railroad, which extends from Whittier and Seward to Fairbanks and has been under the supervision of the Secretary of the Interior since 1915, was transferred to the new Department.

Board on Geographic Names

During fiscal 1966, the Secretary of the Interior and the interdepartmental Board on Geographic Names worked together to standardize the geographic nomenclature required for foreign and domestic maps and other Government publications. They were assisted by the Office of Geography in the area of foreign, oceanic, and Antarctic names and by the Geological Survey in the area of domestic names. Advisory committees on Antarctic names, undersea features, and Arabic and Persian provided essential services.

In September 1965, the Board on Geographic Names marked its 75th anniversary. It continued to cooperate with the United Nations in a program to standardize foreign nomenclature on a broad international scale. The Board's standard names and decisions were made widely available through gazetteers and by its Name Inquiries Service.

Office of the Solicitor

The goals of the new conservation are achieved only by established democratic tools—the laws of the land. The Office of the Solicitor, because of its primary responsibility for creation, interpretation, and application of these laws, played a major role in fiscal 1966 in fashioning new dimensions in conservation.

Participation of departmental lawyers took place on many levels. For example, Interior attorneys formed a major unit of the Interdepartmental Task Force to beautify the Potomac River as a scenic and recreational attraction in the area surrounding the Nation's Capital. Much of the work of the Solicitor's Office concerned establishment of environmental quality standards. An example was the special provisions for control of water and air pollution in proposed contracts for steam generating plants at Fort Mojave and Four Corners on the Navajo Indian Reservation. In addition, Interior's success in its new responsibility for water pollution control and water quality management will depend heavily on advice and support provided by the Solicitor's Office, which played a major role in shaping the reorganization plan by which this program was transferred to the Department of the Interior.

Henry O. Navratil — PPG Products Magazine

Alice Bixler — © National Geographic Society

The Rising Tide

The "third wave" of conservation, which has raised measurably the quality of man's environment, is powered by a rising tide of education.

This educational groundswell—the necessary undercurrent to constructive action—is prevalent at many levels of our democratic society—in the halls of State and Federal Government, in the mass communications media, at public meetings, and, perhaps most significantly, in the Nation's school rooms.

Men and women who have awakened only recently to the urgent need for a broad-based sense of national stewardship must work to see that today's youngsters do not grow to adulthood, as they themselves did, without this awareness. It is such men and women who best can provide the public support for classroom conservation programs . . . the study of our natural resource heritage and how to use it wisely.

Such programs in the schools are aimed first at helping our children form good conservation attitudes and then at giving them the tools for constructive action.

The more fortunate youngsters who now attend schools where conservation is an integral part of the curricula are given an opportunity to develop:

An ecological awareness—a concern for their total environment;

An economic awareness—a feeling for how costs relate to today's ecological problems;

A political awareness—an understanding of their own individual roles as they relate to collective responsibility;

A problem analysis awareness—the ability to *define* resource problems, bring to bear all facets of the situation and all points of view with relation to it;

A realization that man is a part of—not apart from—Nature;

And some grounding in the dynamics of communications between men and groups.

Scouts learn to plant browse seed at BLM conservation area in Utah.

Sea anemones in a tidal pool attract youngsters at Acadia National Park.

Michigan miss (above) takes notes at Kalamazoo Nature Center. Youngsters (below left) study generator model at Reclamation's Denver lab. Below right, Fish and Wildlife Service wetlands manager identifies a plant for children.

Young hikers experience the wonders of Mt. Rainier National Park.

He who knows what sweets and virtues are in the ground, the waters, the plants, the

Similar goals, in less structured forms, are pursued by public and private conservation groups. Citizens are banding together in neighborhoods, cities, counties, and States, to improve the quality of their environment. Their goals range from creating vest pocket parks to cleaning up entire river basins.

The need for action extends beyond even the three dimensions of our total environment. It projects itself ahead in time. The conservation contest is both spatial and temporal, and it is the fourth dimension—time—that makes for urgency. In our race for space we are running very short of time.

The new creative federalism called for by President Johnson is springing to life everywhere. A classic example is the private conservation organization which on a number of recent occasions has rushed in, check in hand, just ahead of the developers, to rescue irreplaceable wild areas and open spaces. These are usually areas being sought by public park and recreation agencies that lacked immediate authority or funds for purchase.

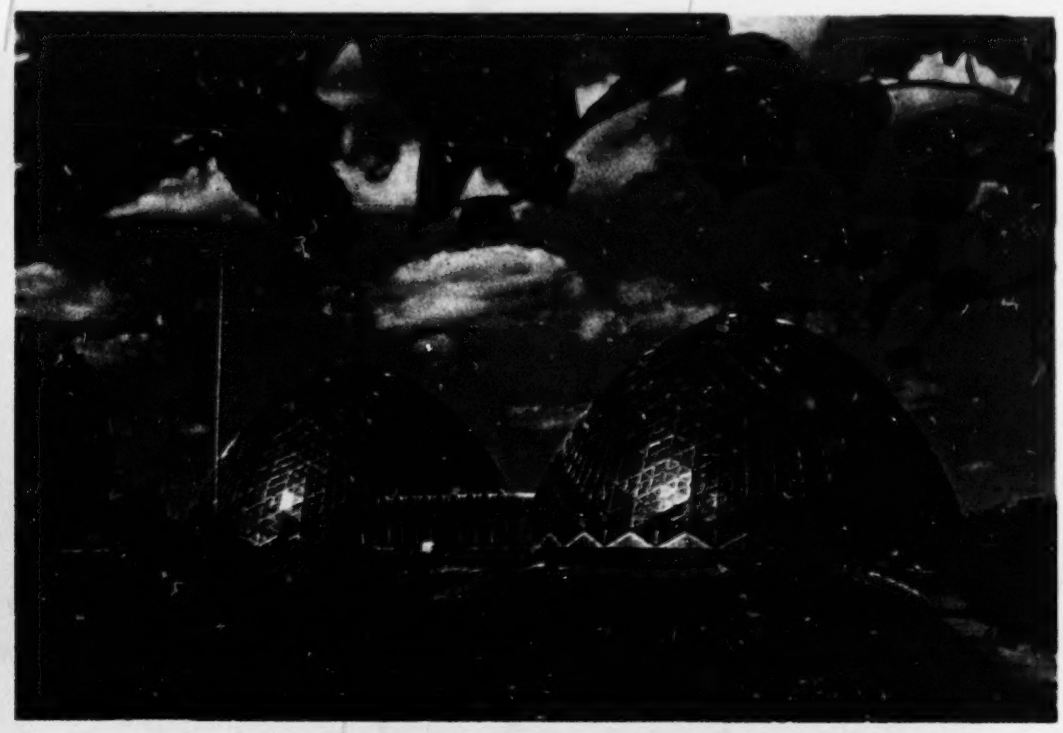
Later, as legislative and administrative pressures allow, the public agencies obtain needed authority or funds to buy the areas from the conservation organization, to the public's lasting benefit.

Thus, today's adults have moved creatively to do battle with current conservation's arch villains—overcrowding and pollution. They are responding with vigor, ingenuity, imagination, money, and muscle.

With conservation education beginning to receive the emphasis it deserves in the Nation's schools, tomorrow's adults will be even better armed. The troops for tomorrow's fight are training today.

Henry O. Navratil — PPG Products Magazine

B. Anthony Stewart — © National Geographic Society



John Alexandrowicz — PPG Chemicals Magazine

Lacy glass, concrete and aluminum hives (above) in Milwaukee, create climate and sustain vegetation of earth's various weather zones. Below, wood life is viewed from a nature center.

Henry O. Navratil — PPG Chemicals Magazine

eavens, and how to come at these enchantments, is the rich and royal man.

Emerson

Already our youngsters are exhibiting a sophisticated grasp of complex environmental problems. An Ann Arbor high school English class, asked to write impromptu themes on conservation, came up with some impressively far-sighted proposals. One called for acquisition of planting easements so that presently tree-lined streets, scheduled for future widening, will find the new curb limits already lined with well-rooted trees when the old avenue sentinels are felled.

Other themes showed understanding of the inter-city action that must accompany any effort to clean up a polluted local river. They recognized the need for pollution control laws and efficient enforcement of these laws before junkyards, smoke, sewage, and industrial wastes can be eliminated from the city scene.

Above all, the theme writers demonstrated a highly articulate talent for describing the problem. One teenager referred to a local housing development as "a barren subdivision, ironically named for the hundreds of elms that grew there before the onslaught of 'progress'."

The reference contains more than just a penetrating insight into the nature of conservation today—it carries a scorn for the numbers-racket method of calculating progress.

We read these signs and we take heart. We know from this, and other examples, that youth feels a growing concern. Even as we now legislate for the near future, our distant tomorrows have a fighting chance.

There are seven seas, and one perhaps besides. That one is the deep, abiding, limitless ocean of education. In its sweep and swell, the "third wave" mounts and gains momentum!

The color in this book . . . was made possible through the loan of color separations of previously printed pictures from the following sources: The National Geographic Society; The National Audubon Society; U. S. Department of Commerce-U. S. Travel Service; The Cleaver Brooks Company; The Campbell Soup Company; Standard Oil of California; Dow Jones and Company, Inc.; Field Enterprises Educational Corp.; The Caterpillar Tractor Company; The Country Beautiful Foundation, Inc.; The Pittsburgh Plate Glass Company; and Time-Life, Inc. The use of color pictures on a one-time reproduction basis has been granted by the many commercial photographers and publications where credited. The usual photographic fees have been waived by those credited. The Department of the Interior extends its appreciation to these firms and individuals for their assistance in supplying many of the special illustrations that helped make this publication possible.

INTERIOR'S CONSERVATION YEARBOOK SERIES

This Conservation Yearbook series format constitutes both the annual reports and the special reports to the nation which have been published in previous years by the Department of the Interior.

The first of the Conservation Yearbook series, published in 1965, is entitled "The Quest for Quality." The second, published in 1966, is "The Population Challenge." Both are available from the Superintendent of Documents at $1.00 and $1.25 each, respectively.

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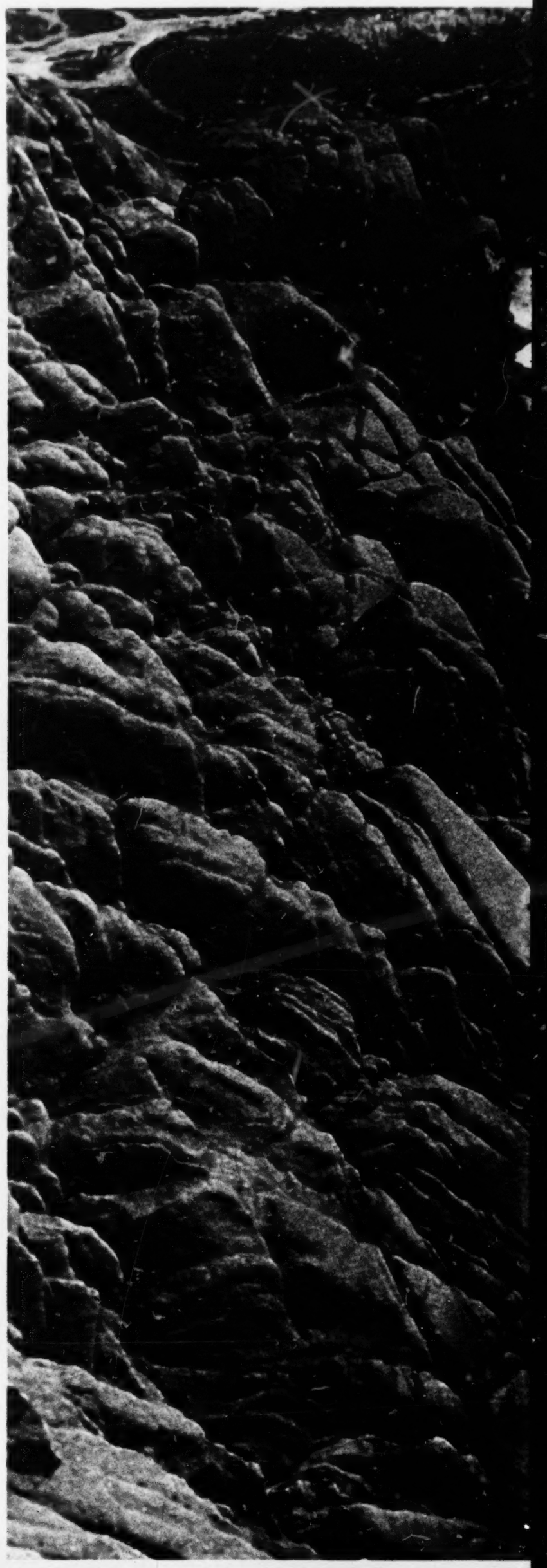
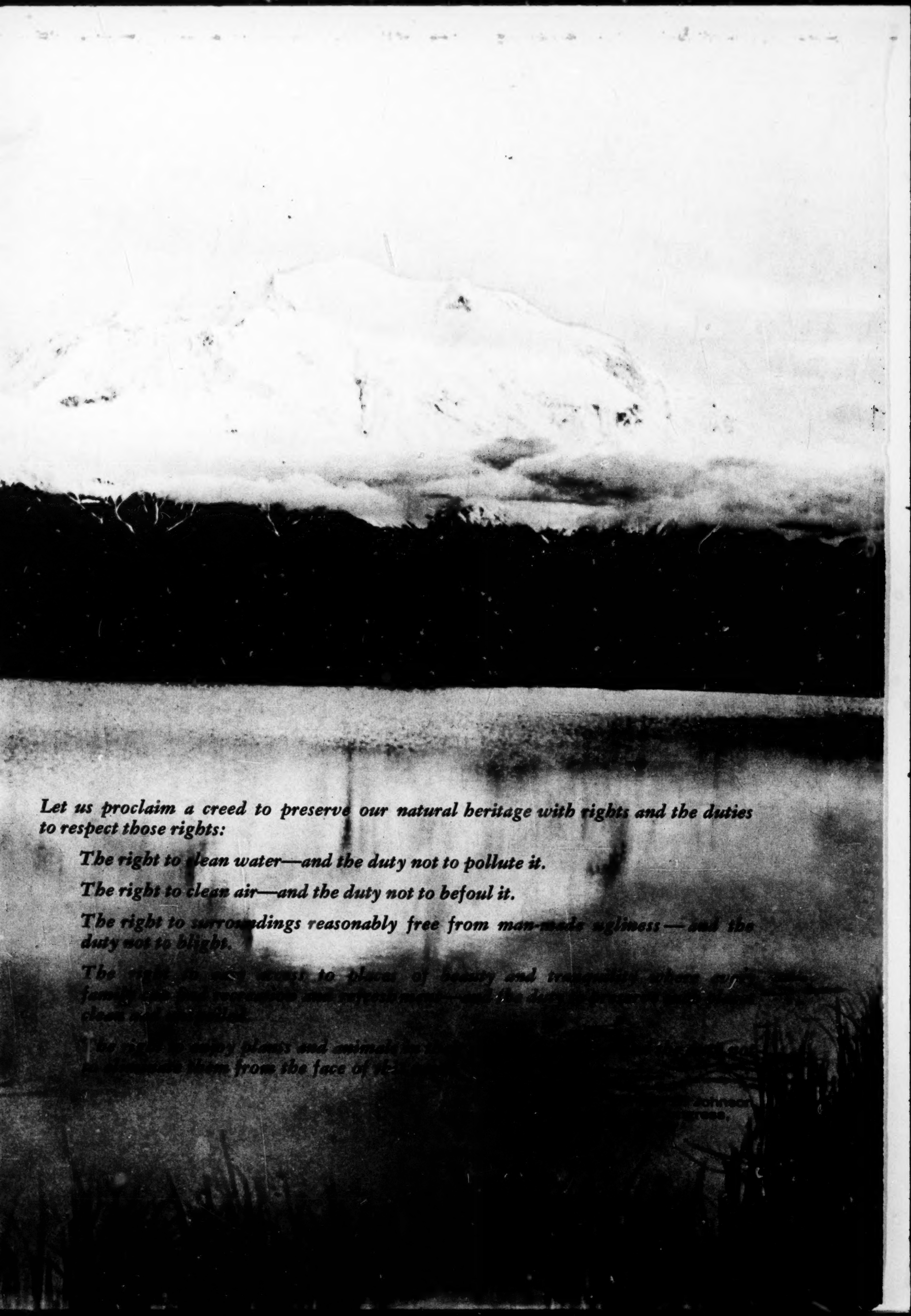


(Back cover) Mt. McKinley, Alaska.

FREELANCE PHOTOGRAPHERS GUILD — Bob and Ira Spring — Country Beautiful Magazine

(Above) A rocky western shore attracts youthful divers.

Henry O. Navratil — PPG Products Magazine



Let us proclaim a creed to preserve our natural heritage with rights and the duties to respect those rights:

The right to clean water—and the duty not to pollute it.

The right to clean air—and the duty not to befoul it.

The right to surroundings reasonably free from man-made ugliness—and the duty not to blight.

The right to easy access to places of beauty and tranquility where [illegible] family can find recreation and refreshment—and the duty to preserve them clean and unspoiled.

The right to enjoy plants and animals [illegible] and the duty not to exterminate them from the face of the [illegible]